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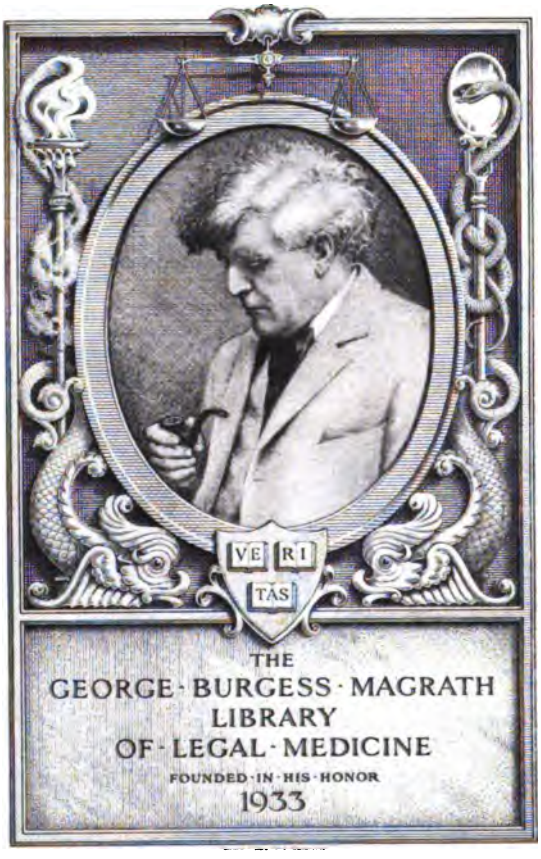

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TRANSACTIONS

OF THE

MASSACHUSETTS

MEDICO-LEGAL SOCIETY

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SOME HISTORICAL AND STATISTICAL FACTS PERTAINING TO THE USE OF ARSENIC AS A POISON.[1]

BY S. W. ABBOTT, M.D.

THE very great increase in the number of deaths from poisoning by arsenic in Massachusetts within the past five years is a sufficient reason for a thorough discussion of the subject by this Society. The drier details relating to that view of the subject, which has fallen to my lot, have less practical importance than those topics which pertain to the chemistry, pathology, and the purely medico-legal side of the subject; hence my treatment of the question will necessarily be brief.

Recent philosophers maintain that it is neither the duty of the State to protect the lives and the health of its subjects, nor to take sanitary measures against infectious diseases, on the ground that such diseases constitute a natural method of weeding out the weaklings of the race. This is only the old Malthusian doctrine in a new dress. They would therefore condemn vaccination, as well as other methods of preventing the spread of disease, including the prevention of deaths by violence. The misapplication is evident, since infectious disease attacks and destroys the robust and the strong as well as the weak: small-pox, typhoid fever, and diphtheria invade the homes of the strong and the healthy as well as those of the feeble, and those of the rich as well as those of the poor. Deaths by violence occur to men of high and low estate. Railroad trains, carrying loads of passengers of all classes, collide with each other, or crash through bridges, without regard to the social or the physical condition of their living freight.

If the suicide is commonly reckoned a worthless member of society, and if the surviving community considers itself better off without him, is society therefore absolved from the obligation of restraining him by the intervention of such laws as may be found to have a restraining effect? It may be urged that the suicide will usually effect his purpose, and that if you deprive him of his fire-arms he will resort to throat-cutting, and if you remove his razor from his reach he will obtain a package of "Rough on Rats," and if you reduce the facility for obtaining poison he will resort to some other means. The enacting of laws for the prevention of this class of deaths is a duty which the State owes to its inhabitants.

The sale of intoxicating liquors has very properly been surrounded with

[1] Read before the Massachusetts Medico-Legal Society, October 3, 1888.

innumerable limitations by statutory enactments. Why should arsenic have been allowed to be sold without hindrance until the present year?

If a score of deaths had occurred in Massachusetts during the past year from hydrophobia, muzzles and dog licenses would have had a lively demand and the whole race of dogs would have been decimated. But the deaths from arsenic considerably exceeded a score.

The following cases, both reported from the Suffolk District, serve to illustrate the need of carefully-enforced and stringent laws relative to arsenic: —

Mrs. ——, aged thirty-two, "living happily with her family and having no assignable motive for the act of suicide, took 'about a tablespoonful' of 'Rough on Rats' in water, at 6.30 P. M., June 13, 1887. Three-quarters of an hour later, having meanwhile changed her dress, and put on clean clothing, she called her husband and told him fully and freely what she had done. When asked why she had done it, she said, 'I don't know. I must have been crazy. I went like a flash to the desk and got the box, and stirred it up and drank it.' A doctor was called, to whom she repeated the story and now added her regret; she willingly complied with all means for her relief." She died in less than eight hours.

A young lad, aged sixteen, after partaking of his supper, complained of pain, and confessed to his sister that he had heard of the article known as "Rough on Rats," and had put some of it upon his strawberries at supper time, to find out how it would affect him. He died in a few hours.

When the use of arsenic has become so common that the housewife finds it conveniently laid away in the desk or sideboard, and the children can readily obtain it for experiment, the statutes already enacted should be vigorously enforced and made still more efficient, if possible.

Historical Sketch. Although the native sulphides of arsenic were well-known to the Greeks and Romans, arsenious acid does not appear to have been known in Europe before the time of Geber (9th century). Reference to the metal may be found in the works of Paracelsus. Some writers contend that it was discovered at a still earlier date by Albertus Magnus (13th century), but the alchemist Brandt first revealed its characteristic properties in 1732, and also the methods for its manufacture.

The poisonous qualities of some form of arsenic were undoubtedly known at much earlier periods, before its chemical nature was recognized. In matters both political and domestic it played a terrible part, and in Italy and other southern countries of Europe its use became very common for secret poisoning. The art of poisoning was practised by fortune-tellers, and so skilful did they become that in some instances it was believed that the poisoner could fix the period for the death of the victim with considerable accuracy. Tofana of Palermo confessed to having destroyed the lives of six hundred persons by poisoning. The celebrated "acqua Tofana" and the "acquetta di Napoli" were undoubtedly arsenical solutions employed for murderous purposes. Madame Brinvilliers, of Paris, who flourished in the 17th century, carefully studied the effects of these Satanic potions, and then by their use took the lives of her father, brothers, and many other people.

In the earlier part of the present century a woman of wealth who lived in northern Germany, Margaretha Gottfried, practised the art of poisoning for fifteen years without detection. The death of fourteen persons was traced to her, and twenty others were known to have taken her poisonous draughts without their proving fatal.

In the same period a Bavarian servant, named Zwanziger, gave arsenic to fifteen persons without exciting suspicion. Christison says that "the practice of such an art requires not only the knowledge of a dexterous toxicologist, but also of a skilful physician; for success must depend on the exact imitation of some natural disease." In a paper upon "Homicide by Poisoning," read by Dr. Wooster Beach before the Medico-Legal Society of New York, the writer cites several instances which would appear to contradict this assertion, so far at least as it is applied to those persons who have in past years resorted to wholesale poisoning as an art.

The Somerville poisoner had in her confidence an arrant quack, who is known to have had a pretty thorough knowledge of certain other poisons besides arsenic, opium in particular.[2]

She had carefully imitated her predecessors in crime, and had it not been for the potent aid which Marsh and Reinsch and Fresenius and host of their disciples have given to the forensic physician, who shall say that Mrs. Robinson might not have appeared in the pages of history by the side of Tofana and Borgia and Brinvilliers as their coequal in crime. It is due to modern toxicology that the horrid schemes of such monsters have been frustrated and the prevention of wholesale poisoning has been attained.

At the present day arsenic as a destroyer of human life has very largely passed out of the hands of the murderer, who sought the lives of many, into those of the suicide, whose object is his own destruction.

As an illustration of the limited knowledge of toxicology of the last century as compared with that of the present day, the following extract is taken from the chemical evidence presented at the trial of Mary Blandy for the murder of her father by arsenical poisoning in 1752.[3]

"A portion of the powder found at the bottom of the gruel administered to Mr. Blandy was given to Dr. Addington. The latter divided the powder and gave a part to Mr. King, a chemist of Reading. Both of these gentlemen experimented upon the powder and concluded it was white arsenic. On being asked 'Why do you believe it to be arsenic?' Mr. King replied: 'For the following reasons: (1) This powder has a milky whitness; so has white arsenic. (2) This is gritty, and almost insipid; so is white arsenic. (3) Part of it swims on the surface of cold water, like a pale, sulphureous film, but the greatest part sinks to the bottom and remains there undissolved; the same is true of white arsenic. (4) This, thrown on red-hot iron, does not flame, but rises entirely in thick, white fumes, which have the stench of garlic and cover

[2] Supplement to Seventh Annual Report of the State Board of Health, Lunacy and Charity, 1885, page 191.

[3] Hargrave's State Trials, vol. x, page 1.

cold iron, held just over them, with white flowers; white arsenic does the same. (5) I boiled ten grains of this powder in four ounces of clear water, and then passing the decoction through a filter, divided it into five equal parts which were put into as many glasses. Into one glass I poured a few drops of spirits of sal ammoniac; into another, some of the lixivium of tartar; into the third, some strong spirit of vitriol; into the fourth, some spirit of salt; and into the last, some syrup of violets. The spirit of sal ammoniac threw down a few particles of pale sediment; the lixivium of tartar gave a white cloud, which hung a little above the middle of the glass; the spirits of vitriol and salt made a considerable precipitation of a lightish-colored substance, which, in the former, hardened into glittering crystals, sticking to the sides and bottom of the glass; the syrup of violets produced a beautiful green tincture. Having washed the saucepan, funnel, and glasses used in the foregoing experiments very clean, I provided a fresh filter. I boiled ten grains of white arsenic, bought of Mr. Wilcock, a druggist in Reading, in four ounces of clear water, and filtering and dividing it into five equal parts, proceeded with them just as I had done with the former decoction. There was an exact similitude between the experiments made on the two dococtions. They corresponded so nicely on each trial, and I declare I never saw any two things in nature more alike than the decoction made with the powder found in Mr. Blandy's gruel and that made with white arsenic. From these experiments, and others which I am ready to produce, if desired, I believe that powder to be white arsenic.'"

Miss Blandy was condemned and executed, denying to the last that she had any knowledge of the poisonous character of the powder which she gave to her father.

Among the references to earlier chemists of the present century it is stated that Orfila claimed that he could produce arsenic from the common soil, and another French chemist said that he could produce it from the legs of chairs. Herepath, on the contrary, experimented largely on the bodies of men, of animals, and of soils, and said that he never had been able to detect arsenic therein, unless it had been intentionally administered for criminal purposes.

Dorvault very properly attributes the common use of arsenic as a poison to the fact that it is so-well known in the arts and processes of manufacture. It is well-known to the dyers of textile fabrics, to the makers of wall-paper, to the taxidermist, to the agriculturist, and to the housewife.

Its similarity in color to that of many useful and common articles of household use, such as sugar, flour, salt, and soda, renders it more liable to cause harm by its accidental substitution, and also gives greater facility to its employment for suicidal as well as criminal purposes. It is for this reason that the British Act "to regulate the sale of arsenic"[4] provides that arsenic offered for sale, not upon medical prescription, shall be colored "with soot or indigo in the proportion of at least one ounce of soot, or a half-ounce of indigo, to a pound of arsenic."

[4] 14 Victoria, chapter 13, June, 1851.

The French laws relating to the sale of poisons date from an early period, the first of which we find any record being that of July, 1680. These early laws do not appear to have been efficient in consequence of their indefinite provisions. Statutes of a more precise nature defining certain poisons, especially arsenic, were enacted in 1846 and 1848. These laws restricted its use and provided limitations which were intended to prevent its use for criminal purposes. Laws have also been enacted in Germany in 1865, in 1879, and also in the past year, with specific provisions limiting the sale of arsenic in every possible direction, whether sold in its crude form, or as entering into the composition of paints, papers, textile fabrics, and other articles of common use.

The almost total absence of laws in the United States regulating the sale of arsenic, undoubtedly accounts to a considerable extent for the increase in the mortality from arsenical poisoning. In reply to a circular from the British Government, issued in 1883, their representative at Washington stated that he had addressed letters to the authorities of each of the United States, and all of the replies received, thirty-three in number, stated that "there was no State legislation or municipal enactment bearing on the matter." On the other hand the same inquiry showed that among the older civilized countries there were scarcely any which had not enacted some restricted legislation upon the subject. Among these laws the Royal Statute of Sweden *relative to the care and sale of arsenic and other poisonous substances and articles* is very complete and thorough in its limitations. Among its numerous provisions it requires that all "apothecaries and other persons engaged in trades or industrial pursuits, using arsenious acid for their business, shall keep an arsenic-book" for recording all their transactions with this poison. It also requires that "arsenious acid shall not be sold or disposed of in any shape for the purpose of destroying flies or rats and other noxious animals, or the embalming or preserving of dead bodies, no matter who may have prescribed or ordered the same."

There may be said to be three methods of dealing with the arsenic question by law:

First. The do-nothing plan, which has practically been the method in this State until the enactment of the Poison Law of 1888. This is the method which is aimed at by the manufacturer and the dealer in arsenic generally. It would appear from the testimony of eminent experts who have been summoned by manufacturers, that arsenic should be reckoned as a comparatively harmless substance, instead of the deadly poison which we know it to be from our own frequent experience as medical examiners. It is usually the manufacturer and the wholesale dealer who is most strenuous in his opposition to the enactment of any laws bearing on the subject.

Second. There is another principle which has gained considerable ground especially in recent years; that of prescribing "allowable limits" for poison as forming a constituent part of many of the articles of household use, not excepting articles of food. This is the refuge of the manufacturer when driven to the wall by the demand for a stringent law, and it seems to me to be

a dangerous principle. It is the manufacturer who alone asks for it, and it is entirely in his interest and not in the interest of the health and the lives of the people. It is in the interest of one and not of the thousand, but singularly enough it is often the one who succeeds in making the law, and not the thousand. In a neighboring State this principle of establishing an allowable limit for a poisonous article has already taken root in the shape of a regulation to the State Board of Health, to the effect that the sale of certain preserved vegetables colored with sulphate of copper shall be allowed, as long as this ingredient shall be limited to a certain definite quantity per pound of the vegetables so colored. Now, since several millions of cans of these articles are annually imported from France, there must be a large sale for such commodities. Copper is not an essential ingredient for the food of man, nor has it any nutritive value whatever. There may be, no doubt, a demand for articles of food of a brilliant green color, but this is not a natural demand, but one which has been created and fostered by the manufacturer. The æsthetic quality in matters of diet, by which an article is made to appeal to the eye, is not its essential quality. The less, then, this principle is allowed to gain a foothold, the greater safety will there be to the consumer. It may be urged that such articles can be safely sold with a guarantee from the manufacturer, but we have already had sufficient evidence that such a guarantee, especially from a foreign manufacturer, would be utterly worthless.

Third. The safest course would be to enact such laws as should limit the sale and the use of arsenic, as well as other deadly poisons, in the most stringent manner possible, and, so far as the common articles of household economy, and especially of food, are concerned, to exclude them altogether. There is certainly no actual necessity for putting poisonous colors into food, nor for coloring wall-papers or articles of clothing with arsenic. To apply the principles of preventive medicine a little more closely we might add that wall-papers might be dispensed with entirely. A clean tinted or whitened wall, either of plaster or of wood, without paper of any sort, is not only more healthful, but in the end more economical than a papered wall. If then, the use of arsenic were to be excluded from the commodities of life, we should certainly find that the deaths from poisoning, suicidal, homicidal, and accidental, would be largely diminished.

Turning now to the statistical side of the question I shall show that so far as Massachusetts is concerned the recent law relative to the sale of poisons was not enacted too soon.

It is only through the aid of the valuable reports of the Medical Examiners of Massachusetts that accurate information can be obtained upon this special form of poison, since, with very few exceptions, the registration returns of different counties do not convey special information as to the character of the poisons employed in cases of death by violence.

The number of deaths from arsenical poisoning in Massachusetts since the enactment of the Medical Examiners' Law of 1877 is as follows:

	Homicidal.	Suicidal.	Accidental.	Totals.
1877*	..	2	..	2
1878	..	2	1	3
1879	..	6	..	6
1880	2	3	2	7
1881	..	3	..	3
1882	..	2	..	2
1883	..	3	1	4
1884	..	16	..	16
1885	..	12	1	13
1886	6	14	2	22
1887	1	35	..	36
Total of each class	9	98	7	114

* Six months.

By this table it appears that there has been a rapid increase in the deaths from arsenical poisoning, from two cases in the half-year of 1877, and three in 1878, to twenty-two in 1886 and thirty-six in 1887. If the five and a half years, 1877–1882, are compared with the five years, 1883–1887, the average annual number in the latter period is found to be more than four times that of the former. This ratio must be slightly reduced by the fact that the returns of the earlier period were voluntary and comprised about two-thirds only of the actual number. With this reduction the increase would still be nearly in the ratio of three to one.

As compared with the living population, the deaths from arsenic were 1.8 per 100,000 in 1887.

As compared with the total mortality they were 8.8 per 10,000.

These figures present a striking contrast to those of England, where, in a population of more than twenty-seven millions, there were only thirty deaths registered from arsenical poisoning, either homicidal, suicidal, or accidental, in the last three years of registration, 1884, 1885 and 1886, which indicated an annual average of .37 per million of the living population, or but one thirty-second as great as that of Massachusetts for the three years 1885, 1886 and 1887. This fact suggests the probability that more efficient restrictive laws have had a large share in limiting the number of deaths from this cause in England.

When we consider the general question of *suicide* by poisoning, as presented by the statistics of different countries, it appears that the ratio of suicides by this method to the whole number of suicides in Massachusetts is much greater than that of other countries.

In England the ratio of suicides by poisoning per million of the population was 9.9 in the last three years of registration. In Massachusetts it was 20.2 for the three years 1885, 1886, and 1887.

In Italy, out of each one hundred suicides by men in 1875, there were five by poisoning; among women there were ten.

In Prussia (1869–1872) the suicides by poisoning were but 2.8 per cent. of all suicides.

In France (1876–1880) out of 10,000 suicides there were but one hundred and ninety-two by poisoning, or 1.9 per cent., as compared with 23.7 per cent. in Massachusetts.

The suicides by poisoning in France were relatively more than twice as frequent among females as they were among males, the numbers being one hundred and fifty-nine per 10,000 among males and three hundred and forty-four among females.

In the following table are presented the statistics of suicide and of suicide

	England, 1884-1886.	Mass., 1885-1887.
Suicides,	6304	511
Suicides by Poison,	801	122
Suicides by Arsenic,	19	61
Ratio of Suicides to population, per 1,000,000,	78	85
Ratio of Suicides to total deaths, per 10,000,	39.6	44
Ratio of Suicides by poisoning to suicides by all methods, per 100,	12.7	23.8
Ratio of Suicides by poisoning by *Arsenic* to suicides by all forms of poisoning, per 100,	2.37	50

by poisoning, and by arsenical poisoning, for England and for Massachusetts, for the last three years of registration in each.

Out of a total of two hundred and eighty cases of death by poisoning, collected by Briande, he states that the poison used in one hundred and ninety-four, or 69 per cent., of the cases, was some form of arsenic. In the greater number of cases it was given in soups or a similar form of food.

Time between the Taking of Arsenic and Death. — The length of the time which elapsed between the swallowing of the poison and death was stated in twenty-nine cases reported in Massachusetts for the past three years, and varied from six hours to six days. No other case is stated to have lived more than twenty-five hours. The average time was fifteen hours and forty minutes. If the excessively long case of six days is excluded, the average time of the remaining cases was eleven hours and five minutes.

The amount of poison taken at once is variously stated from a teaspoonful to a tablespoonful, or from one-third to one whole box of "Rough on Rats."

Certain inquiries are suggested by these data, and first it may be asked,[5] Why do different countries present such striking differences? This difference is by no means imaginary, as is the case in some scientific questions; for example, that of so-called spontaneous combustion, a hypothesis which Casper and Liebig have both shown to be untenable, although a matter of common report in France in early times.

In other forms of death by violence, are also found similar differences among different countries. For example, death by overlaying is a very common form of death among infants in the cities of England, while it is comparatively rare in this country.

Have we then adopted this form of poisoning as a national peculiarity? The comparative statistics quoted would seem to show that we are perhaps unwit-

[5] Casper's Forensic Medicine, vol. i, p. 302.

tingly gaining an unenviable notoriety in this direction. Certain reasons for frequency have already been hinted at in the prevailing and common use of poisons of this character for the destruction of insect-pests and other vermin, as well as rats and other animals. The relative cheapness of arsenic is another reason for its common use, and hence the consequent facility with which excuses can be framed for its purchase by persons meditating suicide.

Another inquiry which naturally suggests itself is, Why should the suicide so often select a method so extremely painful as that of death by arsenical poisoning?

Popular ignorance upon the subject of poisons, and the knowledge that death is an almost invariable result of the administration of liberal quantities of arsenic, undoubtedly furnish the reply. It is not a part of the forensic physician's duty to instruct the people in the principles of euthanasia, so far as poisons are concerned, otherwise we might expect a considerable increase of suicides by painless methods already too familiar in other countries. Possibly it is the prospect of a painful death that may deter some would-be suicides from committing the act.

THE CLINICAL HISTORY OF ARSENICAL POISONING.[1]

BY A. F. HOLT, M.D., CAMBRIDGEPORT.

ARSENIC is by far the best known of all poisons, there being hardly a person in the community but what is familiar with its deadly properties. It can not only be had for the asking at nearly all the street corners, but it is even extensively advertised in the form of rat-poison and Paris-green for the destruction of potato-bugs. It is tasteless and odorless, and can readily be mixed with most kinds of food, both solid and liquid.

These facts, no doubt, in a large degree account for the almost daily occurrence of cases of arsenic poisoning, both suicidal and homicidal. For the perpetration of both these crimes it is probably used oftener than all of the other poisons combined, and its use for such purposes is constantly increasing. In my own limited experience in the last four years, sixteen cases have occurred, nine of these were probably cases of murder, the remaining seven being suicides or attempted suicide.

The exceedingly common use of this substance for criminal purposes makes the subject of arsenical poisoning not only one of great interest to the medical jurist, but also one of which he must have a thorough and critical knowledge for a proper performance of his duties.

The first suspicions of a criminal case of poisoning with arsenic, and it is only with such that the medical examiner has to deal, are usually aroused at the bed-side of the victim; and as such suspicions must often be confirmed or dispelled by the clinical history of the case alone, such a history becomes of great medico-legal importance. Such cases are, as a rule, fairly typical and well-marked, most of them following the same general course and presenting the same prominent symptoms. Unfortunately, however, some of the diseases that result from natural causes present the same general symptoms, and to distinguish between these is always difficult and often impossible.

No better evidence of this can be had than that presented by the notorious Robinson cases. Here were eight cases of criminal arsenical poisoning, seven of them occurring within a period of about five years in one family, and the other in a near relative. All of these cases were treated by physicians of large experience, most of whom are among the very best in our profession, men who, as careful and accurate observers, stand in the very front rank. Yet the real cause of the sickness and death of these victims was not even surmised

[1] Read before the Massachusetts Medico-Legal Society, October 3, 1888.

until a chain of circumstances, unknown, of course, to the physicians, came to the knowledge of the associates of the Robinson family. There was no suspicion of arsenical poisoning in these cases, and nothing to excite such suspicion except the symptoms presented by the patients themselves, and these could readily and properly be accounted for by diseases of every-day occurrence.[2]

Reports of cases of arsenical poisoning are scattered through the medical journals that have been issued within the last forty or fifty years, and such reports comprise very largely the literature of this subject, so far as the clinical history of such poisoning is concerned. All kind of symptoms have been reported to result from an overdose of this substance.[3] Some medico-legal writers have divided these cases into periods, some of one time and some of another; while others have described them as acute and chronic; and the symptoms that are described by writers on the subject represent nearly all the ills that flesh is heir to. No one has attempted to reduce them to order, and I am sure no successful effort could be made to eliminate from them a clear and concise description of the clinical history of arsenical poisoning that would apply to all, or even a majority of such cases. No such effort to eliminate from the mass of symptoms ascribed to arsenic a clear and detailed description of such poisoning will be made in this paper, for the writer has had no better opportunities of observing cases of this sort than his predecessors, and only an attempt will be made to describe such symptoms as will probably occur in such cases, and the order in which they appear, — symptoms that should at least arouse our suspicions of arsenic poisoning where they cannot be clearly and definitely accounted for in some other way.

Arsenic is both a narcotic and irritant poison: sometimes one set of symptoms and sometimes the other, may prevail. It has a specific effect upon the mucous lining of the stomach and bowels, and this effect is produced whether the poison is swallowed or administered in some other way, as for instance, where a considerable quantity is applied to an ulcerated surface.

The time between the taking of a poisonous dose of arsenic and the occur-

[2] There has been a good deal of adverse criticism, not only on the part of the community at large, but in the public press, both as items of news and in editorials, because the physicians in attendance on these cases did not discover their real cause, or at least have their suspicions aroused. The general impression is that they were all treated, or at least most of them, by the same physicians. This, of course, was not the fact. The guilty mother was very careful not to employ the same physician twice; and, in ordering a consultant, she always sent for a different one each time. Not only this, but no more than two of the victims died in one house or one neighborhood. But even had one physician treated them all, his suspicions might not have been aroused. There never was a breath of suspicion on the part of the friends of the Robinson family, who must, of course, have known of all the deaths and the circumstances surrounding their occurrence. As the sickness of these unfortunate people was like that of diseases from other causes than arsenic, diseases, too, of common occurrence, why should the suspicions of the physicians have been aroused more than that of the friends? Doctors are not looking for a murderer behind the door of every house they enter, where there is vomiting, purging and other gastric disturbances the cause of which does not readily appear. A physician who has no more faith in humanity than this, has certainly mistaken his calling, and such an one would be unworthy of confidence or respect.

The people and the press that have made these unjust criticisms forget that cases of poisoning with opium, strychnia, the strong acids, and, in fact, those produced by all the other poisonous substances, are almost invariably detected at once by the physician, even if he has never seen a case of poisoning. The reason of this, of course, is, the symptoms produced by most poisons are clearly defined and distinctive, while those produced by arsenic are not so, but are like those produced by many other causes.

[3] Many unquestionably, even if not a large majority, of the cases of arsenical poisoning that have been reported in the medical journals were observed by men little used to habits of close observation, and less to recording what they saw, and this fact may account for some of the symptoms that have been referred to arsenic; still there can be no question but what under different circumstances of administration, and in different individuals, the results may be variable and widely different in different cases.

rence of the first symptoms is variably stated as being from a few minutes to sixteen hours, depending upon the condition of the stomach. The real cause of the great difference in time in producing poisonous effects is, I believe, largely due to the sparing solubility of arsenious acid (the form in which this poison is usually taken). If, for example, the stomach is covered with mucus, or contains some mucilaginous material with but little water, or if it contained semi-solid food of any kind, the crystals of arsenic might readily become imbedded in it and remain for a considerable period before enough would be dissolved to produce poisonous effects. The usual time for the first evidences of the effect of the poison to appear is from half an hour to an hour. They are rarely delayed more than two hours, and almost never appear sooner than twenty minutes. A single case has been reported where the vomiting and pain occurred almost as soon as the poison was swallowed.

The symptoms of arsenical poisoning as given by one author are as follows: "The symptoms produced by the poison are an austere taste; fetid state of the mouth; frequent ptyalism; continual hawking; constriction of the pharynx and œsophagus; the sensation of the teeth being on edge; hiccough; nausea; anxiety; frequent sinkings; burning pain at the præcordia; inflammation of the lips, tongue, palate, throat, bronchi, and œsophagus; irritable stomach, so as not to be able to support the blandest drinks; vomiting of matter, sometimes brown, at other times bloody; black, horribly fetid stools; small, frequent, concentrated and irregular pulse, but occasionally slow and unequal; palpitations; syncope; insatiable thirst; burning heat over the whole body, or a sensation of icy coldness; difficult respiration; cold sweats; suppression of urine; scanty, red, bloody and sometimes albuminous urine; change in the countenance; a livid circle around the eyelids; swelling and itching of the body; livid spots over the surface, and occasionally a miliary eruption; prostration of strength; loss of feeling, especially in the feet and hands; delirium; convulsions, often accompanied with insupportable priapism; falling off of the hair, detachment of the cuticle, etc. In some cases there is inflammation with burning pain in the urino-genital organs. Occasionally the symptoms have a perfect resemblance to those of Asiatic cholera in a stage of collapse." This author further says: "It is very rare to observe all these symptoms in a single individual," and, "that sometimes they are nearly all wanting, death taking place without any pain or prominent symptom."

From such a confused mass of symptoms as these, indicating disturbance in every part and every vital organ of the body, and these perhaps presented in all conceivable combinations with nothing else to arouse his suspicions of arsenic poisoning except the condition of his patient, how is the physician at the bedside to determine that the case with which he is dealing is one of arsenic poisoning? or how is he to have his suspicions aroused in this direction? Certainly not from arranging in his mind, and keeping before him for instant use, such a confused mass of ills as are here enumerated, as such an attempt could only lead to failure, but rather, I believe, by the careful consideration of the prominent symptoms produced by arsenic, and the order in which they occur.

The first symptom that occurs in these cases, and one that all agree is usually present, is a feeling of faintness or weakness. This comes on in a half-hour or an hour after swallowing the poison, and continues until the more marked symptoms are manifest. This faintness is, I believe, from the physiological effect of the poison. The next prominent symptom, and one, too, that is almost always present, the exceptions being very rare, is vomiting. This usually occurs in from a half-hour to two hours of the ingestion of the arsenic. Occasionally this symptom is delayed; but the above rule would, I believe, include nine-tenths of these cases. The vomiting is violent and incessant, almost always continuing, if the case proves fatal, until death. The vomitus, after the stomach has been first emptied of its contents, consists of a watery secretion mixed with glairy mucus, bile and sometimes streaks of blood. This vomiting is almost sure to occur whenever anything is taken into the stomach. It is accompanied by a severe and pretty constant retching and a burning pain. The pain is referred to the region of the stomach and lower part of the chest. In one case that came under my observation, the patient complained that "she was burning up inside."

Pain in the stomach and vicinity is one of the most marked signs of arsenic poisoning, and is rarely absent: usually it is of the burning character above referred to. This continues to the end. Another pronounced symptom is dryness of the throat and mouth, and great thirst. The patient is constantly calling for water, although he knows that the drinking is sure to excite vomiting. The next prominent symptom to appear, and one that is almost always present also, is the great tenderness on pressure over the region of the stomach. This tenderness is usually very acute, the patient often crying out at the least touch. This symptom is, I believe, one of the most typical of arsenic poisoning. It does, of course, occur in other forms of gastric irritation, but generally it is not so acute, and such cases almost invariably have a very different history. This acute tenderness, accompanied by vomiting, pain and thirst, coming on suddenly in the absence of any known cause, should be considered good ground for suspicion, at least of metallic poisoning.

The next prominent symptom is diarrhœa. This occurs in from one to three hours. The stools are at first yellowish and very loose, afterwards they may become watery and at times bloody. Often there is great and continuous tenesmus, with only the discharge of a little blood. This symptom of looseness of the bowels is not always present. In two cases that came under my observation there was no discharge from the bowels; both of these terminated fatally in about eight hours. In another case, that of a girl sixteen years of age, a profuse watery diarrhœa came on soon after the vomiting, and continued up to within an hour of her death, which occurred in about six hours from the commencement of the poisoning.

The above symptoms usually continue from two to five or six hours, when the pulse becomes quick and feeble, the skin cold and clammy, and perhaps covered with profuse perspiration; the face is pinched; in a word, the victim falls into a state of collapse, in which he may remain for some hours, death

usually occurring, however, in from five to ten hours after the ingestion of the poison. During the last hours of life there are often cramps (particularly in the legs and arms), low delirium, coma and sometimes convulsions. In some of these cases these symptoms continue twenty-four hours, and rarely longer, although all authors agree that a very large proportion of them terminate in nine or ten hours. In cases where the death is deferred four or five days, the vomiting continues, particularly when anything is taken into the stomach. The skin is dry and hot, and after a day or two becomes sallow and sometimes jaundiced; the eyes yellow; the tongue dry and cracked; and the lips and gums bleed readily. The pulse is small and quick; the stomach and bowels are distended and tender; the urine is diminished in quantity, and often contains a large amount of albumen; the cheeks are sunken; there is often delirium and great prostration; until at last the patient sinks into a state of collapse, as in the more acute cases, and dies.

This class of cases is much more likely to escape detection than those where death occurs in a few hours, as the effects are much less pronounced, and some of the symptoms may be absent, or so slight as to attract but little attention. Often there is little or no appearance of a fatal issue for the first two or three days, or until the fatty changes in the liver and kidneys have seriously complicated the case by bringing about a series of symptoms, the result of such changes.

In another class of cases the poison seems to act as a narcotic, the victim complaining of little or no pain or nausea, but sinks into a sound sleep, soon becomes comatose, sometimes convulsed, and in a short time dies. It is this class of cases, and those that rapidly fall into a state of collapse after the pain and vomiting appear, that are the most speedily fatal.

In five cases of which I have had intimate knowledge they have all died in less than nine hours from the inception of the poisoning. In three other cases of poisoning with Paris-green, used for the destruction of potato-bugs, recovery took place, although in one case more than a dessert-spoonful was swallowed; the explanation of this escape probably being that the stuff called Paris-green, used by the farmers, is made up largely of adulterations. The other ten cases that have come under my observation, including the Robinson cases, have lived from five days to six weeks from the time evidences of poisoning were first observed. These deaths were all homicides, and in eight of them the poison was administered by one hand. It is certainly very extraordinary that all of these cases should so widely differ, so far as the deaths are concerned, from the usual rule in cases of arsenical poisoning. In some of these, undoubtedly, the dose was repeated, and perhaps more than once. To me there is no more remarkable fact connected with this notorious series of crimes (the Robinson cases) than this one. How a woman, ignorant of the effects of arsenic except to know that it was a poison, could so graduate the dose in eight successive cases as to delay the fatal issue from six days to six weeks, is beyond comprehension. It was undoubtedly this anomalous result that enabled her to conceal her crime so successfully. One of the deaths was certified as

caused by pneumonia, one by typhoid fever, one by meningitis, one by bowel disease, and one by kidney disease.[4] Had the clinical history of one of these cases been the usual one of arsenical poisoning, with a fatal issue, it is more than probable that the real cause of death would have been detected. The causes of death in arsenic poisoning are the physiological effect of the drug, shock, and irritation of the intestinal canal and other organs. It may be from one of these alone, or from two, or from all of them combined. Cases of death that occurred from this cause within one hour of the poisoning, or even those that occur later, where no irritant effects have been observed, are from the physiological effect of arsenic; those occurring later, and within eight or nine hours, are usually from the physiological effect and shock; while those that occur in three or four days are from irritation and the consequent inflammation, perhaps combined with physiological effects on the liver and kidneys. The diseases that may simulate arsenic poisoning are cholera morbus, colic with vomiting and gastric irritation from other causes. The points of distinction between these and arsenic poisoning, so far as their prominent symptoms are concerned, are not well marked; still, when the whole history of a case of either of these ailments is carefully compared with one of arsenic poisoning following the usual course, there usually are points of sufficient difference to enable one to make a differential diagnosis with a tolerable degree of certainty. For instance, the pain of colic or cholera morbus is usually paroxysmal and griping, or hard; while the pain of arsenic is burning and continuous. There is not often tenderness in either of the former, while this is a well-marked symptom of the latter. The vomiting of arsenical poisoning almost always is the first serious symptom; and this (and the retching) is continuous, or is repeated at short intervals; while that of cholera morbus and colic, if it occurs at all in the latter, comes on later, the pain almost invariably preceding it.

Thirst is a prominent symptom in arsenic poisoning, while it is often absent in cholera morbus and colic. The diarrhœa of arsenic comes on after the other symptoms are well established; in the diseases we are considering, it is often the first sign of disturbance. Cholera morbus and colic usually respond readily to remedies, the pain and vomiting ceasing; and health is rapidly restored. And they are almost never fatal, except in the old and feeble; while, in arsenic poisoning, the case goes on from bad to worse, in spite of treatment, to a fatal issue. Therefore, the severity of symptoms is another of the cardinal points in differential diagnosis. Cases of gastric irritation of severe type may, under certain circumstances, simulate arsenic poisoning very closely; but fortunately such severe irritations are of rare occurrence, and usually they can be traced to some well-marked and definite cause. Cases where such well-marked cause does not appear should at once arouse suspicion of metallic poisoning. In such cases, where the vomiting continues without apparent

[4] It perhaps should be further stated that in all of these cases the guilty mother selected a time to administer the poison when they were sick. For example, the sister had been suffering nearly a week with pneumonia before Mrs. Robinson saw her; the husband, whose case was supposed to be one of typhoid fever, came home from Boston suffering so severely with pain, nausea and vomiting that a physician was at once sent for; while Willie, the last victim, was under medical treatment from the result of a fall.

cause, the settlings of vomitus should be examined for crystals of arsenic, and sent to a chemist for analysis. This matter, however, belongs to the medico-legal considerations of arsenic poisoning rather than to its clinical history.

In cases of arsenic poisoning where death does not occur for some days, the prominent symptoms, as has already been said, are usually less well-marked: consequently the diagnosis is more difficult. Such cases can only be determined by a careful consideration of their histories and surroundings, examination of the vomitus for crystals of arsenic, and chemical analysis of the urine, as this poison is largely eliminated by the kidneys.

Chronic arsenical poisoning occurs occasionally from the repeated administration of small doses, although there is little likelihood of this being attempted for purposes of crime, except possibly by one thoroughly familiar with its action. These cases may present all the symptoms of the acute form of poisoning, although usually in a mild degree; and to these may be added extreme nervousness, trembling, paralysis (particularly of the hands or feet), tingling in the fingers and toes, a vesicular eruption on the body or limbs, suffusion of the eyes, ulceration of the mouth, jaundice, strangury, etc. The patient becomes emaciated, prostrated, and finally dies from exhaustion or disease of the kidneys. One of the Robinson cases was of this kind, the patient, a girl twenty-two years of age, living six weeks after the first symptoms of poisoning showed themselves. In this case there was paralysis of both feet, and the urine contained albumen and casts.

As has been already said, there are no distinctive symptoms of arsenic poisoning, and one can only be certain he is dealing with such a case when the poison is found in the vomitus or urine, or there is other proof that it has been administered. The physician should be reasonably alert in trying to determine the causes of cases that come under his observation where there is vomiting, purging, pain, etc.; but it is no part of his duty to suppose that all such cases are the result of metallic poisoning.

THE ANATOMICAL APPEARANCES RESULTING FROM POISONING BY ARSENIC.[1]

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THE notes presented in this brief paper relate solely to that class of cases of arsenical poisoning which may be properly designated as acute—cases, in other words, in which death follows a single toxic dose of arsenious acid after an interval of time not exceeding forty-eight hours. The anatomical appearances here described will be, in the main, such as the writer has himself observed in his inspection of the dead bodies of persons who have killed themselves with arsenic. In these observations, the toxic effects of this poison have seemed to take a wider range and a more comprehensive character than the standard text-books of toxicology would lead one to believe. The writers with whom students of forensic medicine are most familiar, such as Taylor, Guy, Casper and Reese, give the distinct impression that arsenical poisoning is essentially an affair of the stomach and intestines, and that other organs and regions have either no interest at all, or an interest so remote as to be hardly worth mentioning. The appearances which the gastric and intestinal mucous membrane presents are generally described with great particularity of detail; and the color-effects, the red evidence of "irritation," are especially elaborated to impress the memory; for to nearly all authors of toxicological works, arsenic is a typical "irritant" poison, and, being such, its characteristic effect should be inflammatory redness. Moreover, it is fair to state that toxicologists are usually distinguished as chemists, not so much specially interested in the anatomical appearances of organs as in the best methods of recovering the largest amount of poison from those organs; if they see anatomical specimens from the victims of arsenic, it is not usually at the autopsy-table, but after an interval of hours or days, when the organs are submitted to them in the chemical laboratory, and after exposure to air and the conditions favoring decomposition have materially modified the original appearances. It is for these reasons that the descriptions which are given in the standard text-books on poisons, so far as they relate to the post-mortem appearances left by arsenic, are incomplete and unsatisfactory. I shall be pardoned, therefore, if in addition to the mention of certain anatomical features of arsenical poisoning, well-known because oftenest found in the books, I include other features less familiar, but scarcely less interesting or important, which I have personally noted.

[1] Read before the Massachusetts Medico-Legal Society, October 3, 1888.

Let us suppose, now, that the dead body of a man is found. He has taken a quantity of arsenious acid in secret with suicidal purpose, and has carefully destroyed all the evidences of his act and intent. He has died without antidotal treatment, and his dead body affords the only present available proof of the cause and manner of the death. What are the indications which the medical examiner finds at the autopsy to suggest to him that arsenic was the lethal agent, and to guide him as to the propriety of chemical confirmation of his post-mortem diagnosis?

It is not to be understood that these data for diagnosis are uniform in kind or in degree in all cases; in this respect, arsenical poisoning is not different from most pathological processes. The changes which result from the ingestion of a fatal dose of arsenic are subject to manifold modifications. The state of the stomach in its relation to the last meal of food, the amount of its fluid contents, and other conditions interfering with the direct disposal of the poison, will at once occur to the mind as factors to control the post-mortem appearances. Time, too, is an important element in the matter; the interval between the ingestion of the poison and the death of the patient, and the interval between the death and the autopsy, ought to be considered in this connection. But perhaps the most striking modification, and one that is not sufficiently noted in descriptions of the stomach and intestines after arsenical poisoning, is that due to the treatment which the patient receives. Much of the so-called "inflammation" in these cases is caused, without doubt, by the arsenic; but not a little of the redness of the mucous membrane is more readily traceable to the mustard and other emetics, to the iron and other antidotes, to the irrigation and other measures designed and applied with proper vigor and assiduity for the relief of the patient. Of the arsenical stomachs which I have seen, that one best fulfilled the description of the text-books which had received, during the life of its owner, copious doses of hydrated sesquioxide of iron urged upon her as long as she could swallow during the nine hours which intervened between her poisoning and her death.

Avoiding, in our review of the post-mortem appearances referable to arsenic, this and other sources of error as far as we can, let us study the anatomical changes which an uncomplicated case of acute poisoning would probably present.

Externally, the body would present but few indications of the cause and manner of the death. The facial expression usually suggests suffering in the last moments of life, in harmony with the characteristic clinical course of events. The degree of post-mortem rigidity is marked. If the subject is plethoric, widely extended patches of livid discoloration occupy the dependent parts of the body; sometimes, the dull bluish color of these lividities is replaced, in part, by a rosy red, a change particularly noticeable if the autopsy is delayed. The skin frequently shows another change from its normal post-mortem color or pallor, and this consists in a sallow or yellowish hue, suggesting icterus. I have observed in some instances a narrow line of ecchymosis upon the prolabial mucous membrane, that of the lower lip especially, to be

explained probably as an incident of the clinical history of the poisoning, as it was most marked in cases in which vomiting was a marked symptom. Exceptionally, the tongue is seen to be reddened, but otherwise the cavity of the mouth and pharynx presents nothing remarkable.

Turning now to the internal parts of the body, let our examination take the usual course, as if we had no clue to the cause of the death and our inquiry of the several organs was to determine that clue and establish the diagnosis. Orth says:[2] "In medico-legal cases, in which a well-founded suspicion may be formed as to the cause of death, the rule is to begin with that cavity in which the suspected changes are to be found." In our present study we assume that we are not in possession of this "well-founded suspicion," but that we approach our inspection without any bias or preconceived theory.

The brain and its envelopes will give us negative information. Although the brain is said by some chemical authorities to have a special affinity for arsenic, and that hence it has very great value as material for chemical examination, the presence of the poison does not leave any characteristic objective impress upon the organ. Most of the authors on toxicology make no mention of this region in describing the anatomical appearances due to arsenic; if any note at all is made, it is to remark that "congestion" is sometimes observed. In my own cases, the injection of the cerebral and meningeal vessels has been remarked mainly in cases in which morphia was used to allay the toxic symptoms.

The organs of the thoracic cavity next demand our attention. In cases in which death has followed quickly after the ingestion of a fatal dose of arsenic, the heart escapes injury; the color and consistency of its muscular tissue remain normal. But if life be prolonged beyond eight or ten hours, parenchymatous changes are developed, and the normal red color of the ventricular walls becomes changed to pale or yellowish, while the consistency of the muscular tissue is diminished and is friable under pressure, a condition betokening fatty degeneration. Just when this change in the cardiac muscle begins, it is difficult to state with definiteness; it is an early effect of arsenical poisoning and coincides with the absorption of the poison into the blood. It is certainly a rapid change and must be one of the factors in the cause of death. I have seen it in a case in which death followed after an interval of six hours; and, on the other hand, it was not manifest in the heart of a young woman who survived ten hours.

Another appearance in the heart, and one that I have been disposed to consider as characteristic of arsenical poisoning, is the presence under the endocardium of the left ventricle of ecchymoses, not larger than a dime and usually limited to the posterior wall or the interventricular septum. These ecchymoses are generally single, and they rarely exceed two in number. In depth they are superficial, section displaying simply a thin layer of blood under the endocardium. In one instance I have seen ecchymoses on the external surface of the heart under the visceral pericardium; they were about the size of a split

[2] A Compound Diagnosis in Pathological Anatomy, p. 40.

pea, and were found mostly on the upper part of the left auricle between the aorta and the appendix auriculæ.

The blood in most cases is dark in color and fluid in consistency, whether it be observed in the right ventricle or in the large arteries. It is described as "syrupy" by some writers, but my cases have not yielded a result that could be designated by that term, unless the syrup were understood to be very thin.

Writers on poisons have not found anything note-worthy to state concerning the lungs, with reference to their appearance after death by arsenic. Yet there are one or two features growing out of the condition of the blood that seem deserving of mention. The fluid state of the blood permits its ready gravitation to the dependent portions; hence we generally find an unusual degree of hypostatic blood-supply. In some cases, the blood takes on color-changes which show best in the lungs; the anterior and upper portions are of a florid, almost vermilion hue; while the posterior and inferior parts retain their dark purple. The appearance of the lungs in these instances is not unlike the effect produced by carbonic-oxide poisoning. Another phenomenon referable to the blood is the presence of capillary hæmorrhages under the visceral pleura; these are few in number, varying in size from that of a mere point to that of a grape-seed, and they are usually limited to the lower parts of the lung and to the fissures.

Turning now to the abdominal group of organs, and following in our description the usual order, we note, in the first place, that the vessels of the peritoneum, in our hypothetical case of arsenical poisoning, are almost invariably injected to a marked degree.

The spleen gives us nothing of value in our search for data; so far as our present inquiry is concerned, it is of no service to us.

The kidneys present an interesting degenerative alteration, which has received less attention than it has deserved. In proportion to the length of time which has elapsed between the ingestion of the arsenic and the fatal result, these organs will be found to display, in greater or less degree, the evidences of parenchymatous change, due probably to the irritant action of the poison circulating in the blood and seeking an avenue for elimination. At first this change manifests itself in the form of "cloudy swelling," so-called, in which the kidney loses its normal grayish-red color and its firmness, becoming pale and soft and increasing somewhat in size. These changes progress till true fatty degeneration takes the place of the granular degeneration of the earlier stages, and the organ is yellowish gray, flaccid and enlarged. Its section shows a somewhat thickened cortex, yellowish gray in color, with marked opacity, and presenting yellow streaks and spots indicating fatty degeneration of the tubules. The contrast between this portion of the organ and the appearance of the medullary pyramids is distinct because the vessels of the latter are relatively full. Upon microscopic examination, the granular epithelium of the tubules shows an increase in its granular elements, with indistinctness of their nuclei.

These changes begin and go forward with remarkable rapidity, coinciding

in this respect with the analogous degeneration of the muscular tissue of the heart. All conditions which favor the ready absorption of the arsenic promote the parenchymatous changes which have been described. In the case of a girl of sixteen, who took a box-full of "Rough on Rats" in water on an empty stomach, and died eighteen hours later, I found the kidneys presenting the characteristic appearances of the earlier stage of fatty degeneration. On the other hand, these appearances were absent from the kidneys of a young woman who died nine hours after swallowing half a box-full of the same handy preparation of arsenious acid.

The pelvic viscera yield no data that are of service in the post-mortem diagnosis of arsenical poisoning. Sometimes the bladder displays in its lining membrane some dull red spots, but these are neither constant nor characteristic.

The appearances presented by the œsophagus are of interest because the mucous membrane of this tube comes into intimate contact with the poison on its way to the stomach, and might well be expected to give local evidence accordingly. As a matter of fact, however, this canal is generally of normal appearance. Rarely, there are patches or long narrow streaks of dull redness. In one case, in which the body of a woman was exhumed for examination ten days after her death, I observed some bright yellow deposits on the mucous membrane of the gullet, the result of the action of the sulphuretted hydrogen of decomposition upon the arsenious acid.

The stomach is the one organ which before all others possesses in the eyes of most medico-legal observers a paramount importance. It receives the poison immediately upon its ingestion, offers its extensive expanse of mucous membrane to the local action of the irritant, engages actively both in assimilating and in rejecting the unwelcome guest and takes in, as well, a variety of agents designed to expel or neutralize the toxic material. It is not strange, therefore, that the post-mortem appearances presented by this organ after a fatal dose of arsenic should have challenged the close attention of medico-legal pathologists. These appearances take a wide range in kind and degree. On the one hand, it is not a very rare occurrence to find a stomach which has suffered no damage whatever by receiving a poisonous dose of arsenic; so far as its gross appearances are concerned, it shows a surprising immunity from the effects which are supposed to be typical; and, studied by itself, it would readily be pronounced normal. On the other hand, we find appearances indicating to the fullest degree the irritant action of the poison, general redness, either of a bright scarlet hue or more often of a dull brownish shade, diffused and confluent in extensive patches of submucous ecchymoses or arranged in parallel streaks which on closer examination are found to represent series of minute hæmorrhagic dots. Between these two extremes, each of which has but relatively few examples to illustrate it, we find all degrees and varieties. A common observation is to find the mucosa thrown into long folds or rugæ by the contractions of the muscular coat of the stomach, and these rugæ are marked at their summits by dull, brownish-red discolorations, or present numerous transverse red lines arranged so closely together as to give the effect

of a continuous longitudinal streak. The part of the stomach mostly involved in the change is the pyloric end, and here the redness indicating sub-mucous extravasation is generally diffused, giving the surface something like the appearance of red velvet. Occasionally, one is fortunate in finding deposited on the mucous membrane unmistakable evidence of the cause of death, in the form of thick, pasty, whitish-gray patches which are firmly adherent; these are surrounded by a line of vivid crimson, and if the pultaceous mass is carefully scraped away, the under-lying mucous coat will be found to display a similar intensity of inflammatory redness, but without the erosion characteristic of an ulceration. Examination of the pasty material with a good lens reveals the typical crystals of arsenious acid. Besides this adventitious lodgement of the poison upon the gastric mucosa, one sometimes finds large areas of the surface covered with a layer of thick tenacious mucus, giving a suggestion of diphtheric exudation. There is, moreover, a swelling of the mucous membrane, demonstrated by the obliteration of the normal line of demarkation between the œsophagal mucosa and that of the stomach. The microscope detects in the gastric glands changes which correspond with those already described in connection with the heart and kidneys; namely, cloudy swelling of the cells lining the glands, followed at a later stage by their fatty degeneration. It is, perhaps, needless to add that the changes in the stomach due to arsenic are confined to the mucous coat, the muscular and serous coats escaping injury.

The contents of the stomach in arsenical poisoning deserve a passing word. Notwithstanding the violent vomiting which forms such a predominant clinical feature in these cases, the stomach is never found empty, but the amount of matter which it retains is often sufficient to excite surprise. Generally the contained matter consists of a pint or more of thin grumous fluid, brownish-red in color and without odor. Sometimes this fluid has a distinctly reddish tinge from the blood which it contains; if it be placed in a glass jar and allowed to stand a few minutes, this blood-stained portion forms a layer at the bottom, and its hæmorrhagic character is more easily demonstrated. An occasional feature in the gastric contents is the presence of white, soft, flocculent masses floating in the fluid.

The intestines present appearances which are analogous to those just described in connection with the stomach, but in general they are less striking; moreover, lesions of the gastric mucosa and those of the intestinal tract do not correspond in degree in the same subject, for it is not unusual to find typical hæmorrhagic gastritis fully developed, with scarcely any alteration of the intestinal coats. Of all parts of the small intestines, the duodenum shows the effects of arsenic most frequently and most satisfactorily; we observe here the same redness of submucous ecchymosis which the lining of the stomach presents. The summits of the mucous folds are especially the seat of the change; and here, too, one sometimes sees small patches of vivid crimson overlaid with a white pasty deposit, marking the lodgement of the arsenic. Other parts of the intestinal mucosa offer no constant lesion; it is most often found reddened in larger or smaller areas somewhat widely distributed. It is an error to fancy

that arsenic leaves its irritant traces uniformly, and that in fatal poisoning by that agent there is in the intestinal lining a general diffused inflammatory redness from the pylorus to the cæcum; such wide-spread effects are occasionally seen, but they are the rare exception.

The contents of the small intestines are fluid, and in general resemble thick rice-water, through which are distributed flocculent lumps of soft whitish matter, and sometimes masses of the poison itself in the form of white, pultaceous collections. If the hæmorrhagic lesion of the gastric and duodenal mucosa is very marked, the blood which has escaped in consequence will give a brownish-red hue to the contents of the intestines.

The colon and rectum are almost always found contracted and empty, with a soft, swollen, grayish lining membrane, covered with white stringy mucus. The redness which is observed in the small intestine and the stomach is not continued in the lower bowel except in protracted or chronic cases of poisoning. It has not been my fortune to observe it in any acute case.

Last and largest in the list of organs which we question for evidence of poisoning, is the liver, the special store-house of the lethal agent. The one characteristic change wrought by arsenic consists of fatty metamorphosis, a change analogous to that observed in the heart and kidneys. In gross appearance, we find the liver slightly increased in size, if changed at all, rather firmer in consistency than in the normal state, and displaying externally and on section circumscribed yellow areas; or, if the change has gone forward to an extreme degree, the entire organ presents a uniform light-yellow color having wholly lost its normal reddish-brown. Here, again, as in the heart and kidneys, the change is a rapid one, a few hours sufficing to reduce the organ from its normal state to a condition in which fatty degeneration and fatty infiltration are associated, the former a late stage of parenchymatous (granular) inflammation, the latter an incident thereto.

This review of the anatomical appearances left by arsenic upon the human body leads directly to the question which is of paramount medico-legal importance; namely, Is post-mortem diagnosis of arsenical poisoning an easy matter? That is to say, assuming, as we assumed at the beginning of this paper, that we are in the presence of a dead body of whose clinical history we know nothing, are the revelations of the autopsy sufficiently characteristic and unequivocal to warrant one in concluding readily that the death was by arsenic? The answer is in the affirmative, upon the single condition that the data are studied in their associated relation, and that their collective significance is the evidence which guides the examiner. There is no single organ whose testimony is sufficiently conclusive to control the diagnosis, with the possible exception of the finding of deposits of the poison upon the gastric mucosa, with a marked degree of inflammatory redness beneath and around them; but short of this, the condition of the stomach, however striking its inflammatory character may be, is suggestive only, the various degrees of irritant effects being explainable by numerous causes other than arsenic. But when, in addition to the presence

of gastritis, one finds fatty degeneration of the heart, kidneys and liver, a fluid and dark condition of the blood, and sub-endocardial ecchymoses, he may with clear conscience testify in court that he is of the opinion that the death was by arsenic. In this conclusion, he would probably be confirmed by the results of a properly conducted chemical examination of the viscera. Indeed, without the gastric and enteric data, or with only an insignificant and equivocal degree of inflammatory reddening of the mucous membrane of the digestive tract, the concurrence of fatty changes in the heart, kidneys and liver should arouse the examiner's suspicions, and suggest to him the propriety of seeking the chemist's aid to verify his surmises.

In this paper, I have purposely refrained from discussing controverted questions relating to arsenic and its effects on the system, preferring to set forth in as clear and intelligible a manner as possible the anatomical data of acute arsenical poisoning as I have observed them or as they are agreed upon by standard authors, rather than to indulge in the examination of speculative points or to quote the diverse opinions of various writers upon unsettled problems pertaining to the main theme. Certain incidental topics, too, like the influence of arsenic on putrefaction, the technical methods of conducting a medico-legal examination in a case of arsenical poisoning, and the proper way of preserving and transmitting material for chemical examination, have been purposely omitted. If the simple and uncomplicated sketch here offered shall serve to promote the practical aims of legal medicine as represented in this Society, its design will have been fulfilled.

THE CHEMISTRY OF ARSENIC.[1]

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ARSENIC, although one of the rarer elements, is in small quantities very widely distributed. It is found native but more commonly in combination with certain metals, notably iron, cobalt and nickel, and with sulphur. The most important arsenical ores are arsenical iron, $Fe\ As_2$; arsenical pyrites or mispickel, $Fe_2\ As_2\ S_2$; realgar, $As_2\ S_2$; orpiment, $As_2\ S_3$; arsenical nickel, $Ni_2\ As_2$, and tin-white cobalt, which is composed essentially of arsenic and cobalt. Less frequently arsenious oxide and salts of arsenic acid are met with. The most abundant of these ores is mispickel, and it is from this chiefly that arsenic and its compounds are prepared on the large scale as a principal product. Large quantities are, however, obtained as a secondary product in the working of the ores of tin, copper, cobalt and nickel. The ores of arsenic are found in various parts of the world, but are especially abundant in certain European localities, as Styria, Silesia, the Hartz mountains, and in Cornwall and Devonshire in England.

Arsenic in small quantities occurs in many minerals other than those above mentioned. It is found, for example, in most specimens of iron pyrites; consequently it is a common impurity in sulphuric acid and in numerous chemical and pharmaceutical products in the preparation of which this acid is employed. The ores of bismuth frequently contain arsenic; as a result, the pharmaceutical preparations of bismuth are likely to be arsenical, unless the metal from which they are prepared is first purified, or exceptional care taken to eliminate arsenic in their preparation. The ores of zinc are usually arsenical; consequently metallic zinc, which is employed in the most important test for arsenic may contain more or less arsenic as an impurity.

The wide distribution of arsenic is of great importance in its relations to medico-legal investigations involving a question of arsenical poisoning.

(1) Since certain reagents employed in analytical work are liable to contamination with arsenic, it is the duty of the chemist, who is called upon to make an examination of the organs of the body, or of other material in a case of suspected arsenical poisoning, to ascertain that all the reagents and apparatus used in his investigations are entirely free from arsenic. For this purpose, a blank experiment, using the same reagents in essentially the same

[1] Read before the Massachusetts Medico-Legal Society, October 3, 1888.

amounts, and the same apparatus, must be carried on side by side with the examination of the organs or substances under investigation. Among the reagents employed in an analysis for arsenic, sulphuric and hydrochloric acids and metallic zinc are especially liable to contain arsenic as an impurity; while sodium carbonate and potassium chlorate have occasionally been found arsenical. Glass and the glaze of porcelain may also contain arsenic, which may be communicated to certain reagents, especially the fixed alkaline hydrates. While there is no difficulty at the present time in obtaining reagents free from arsenic, yet the chemist should personally test the purity of these; and a failure to do so is properly sufficient ground for the rejection of the chemical evidence.

(2) Owing to the occasional presence of arsenic in pharmaceutical preparations, it is important, in medico legal investigations involving the question of arsenical poisoning, that such medicines as have been administered just prior to and during the sickness of the individual supposed to have been poisoned, be submitted to the chemist for analysis, that he may be able to say, if possible, that the arsenic found in the organs or excreta could not have had its origin in such medicines. This procedure is especially necessary in cases in which subnitrate of bismuth has been administered. This preparation formerly contained, as a rule, more or less arsenic; sometimes a considerable quantity. Consequently the arsenical impurity in bismuth is invariably urged by the defence, provided bismuth has been administered, in explanation of the arsenic found. As now prepared it rarely contains more than the faintest trace of arsenic. Yet a failure to submit for analysis any sample actually administered might aid in defeating the ends of justice. Solution of ferric chloride may also be mentioned as a medicinal preparation in which an appreciable amount of arsenic may be found.

(3) On account of the wide distribution of arsenic in small quantities, traces of arsenic are occasionally found in the body in cases in which death has not been the result of poisoning. Such traces may have their origin in drugs administered during life (either arsenical preparations as Fowler's Solution, or medicines containing arsenic as an impurity), or more frequently perhaps in the dust given off from arsenical papers or fabrics. The possibility of the latter origin of arsenic found in the organs is usually urged by the defence, even in cases in which the amount of arsenic recovered from the organs is large. In the majority of cases the quantity of arsenic found, if any, is sufficiently large to justify the opinion that it could not have had its origin in the manner suggested: and a similar opinion is warranted in case arsenic or any of its compounds is found in the stomach or intestines in the solid state. But the detection of mere traces of absorbed arsenic is by no means necessarily indicative of arsenical poison. In the case of Madame Laffarge, Orfila obtained from the body a quantity of arsenic estimated to be about the one hundred and thirtieth part of a grain. The woman was convicted. No importance whatever would be attached at the present day to the detection of this amount of arsenic in the body.

COMPOUNDS OF MEDICO-LEGAL IMPORTANCE.

In addition to metallic arsenic, the following compounds of arsenic possess more or less medico-legal importance: Arsenious oxide, called also arsenious anhydride, arsenious acid, white arsenic and arsenic: the arsenites of sodium and potassium; the aceto-arsenite of copper (Paris green, Schweinfurth green); the arseniates of sodium and potassium; arseniuretted hydrogen; the yellow sulphide of arsenic or orpiment, and the red sulphide or realgar.[2]

Metallic Arsenic. — The metallic arsenic occurring in commerce is either native arsenic or more commonly the artificial product obtained by heating arsenical iron or arsenical pyrites in a closed vessel. It is also prepared by subliming a mixture of arsenious oxide and charcoal, and may be obtained from the sulphides by heating these with a mixture of charcoal and an alkaline carbonate or potassium cyanide. It is a very brittle crystalline substance, of a steel-grey color, specific gravity about 5.75. It has a bright metallic lustre, and conducts electricity readily. Hence, although in all its chemical relations a non-metallic element, it is usually called *metallic* arsenic, to distinguish it from *white* arsenic to which the term "arsenic" is popularly applied. It undergoes no marked change in dry air at the ordinary temperature, but in moist air, especially if in the finely divided state, it absorbs oxygen with considerable rapidity and is converted to arsenious oxide; and it is probable that it is poisonous only in so far as it becomes oxidized either by exposure to the air or by contact with the fluids of the stomach and intestines. One of the substances known as fly-paper is such a mixture of arsenic and arsenious oxide, containing, it is said, from four to eleven per cent. of the latter substance. Metallic arsenic is readily volatilized, and the vapor in contact with air emits a peculiar garlic-like odor. Heated in air it takes fire and burns with a livid blue flame and evolution of dense white vapors of arsenious oxide. Its combustion is attended with the peculiar odor referred to. If pure it is insoluble in water; but when the oxidized product is boiled with water, arsenious oxide is dissolved, and may be detected by appropriate tests applied to the solution. The best solvent is concentrated nitric acid, which oxidizes it to arsenic acid. Metallic arsenic is used chiefly for the purpose of hardening lead in the manufacture of shot.

Analysis.[3] — Heated in a narrow reduction tube metallic arsenic is converted to a vapor, which recondenses as a sublimate in the upper and cool part of the tube. The lower part of this sublimate presents an iron-grey appearance, and the upper part a dark-brown color, gradually fading to a grey ring in which octahedral crystals of arsenious oxide may usually be detected. Very thin sublimates have a light-brown color. An arsenical sublimate is distinguished

[2] Poisoning, resulting from the domestic use of arsenic, for example from paper-hangings, glazed paper, fabrics, etc., has been recently treated in a thorough manner by Edward S. Wood, M.D., in the Report of the Massachusetts State Board of Health, Lunacy and Charity. The consideration of this subject is therefore omitted in this paper.

[3] Only such tests are described in this paper as may readily be applied by the physician to solids suspected to be arsenic or one of its compounds. Works on toxicology may be consulted for a description of wet tests for arsenic, and for information regarding the systematic examination of organic liquids or solids for arsenic.

from sublimates produced by other volatile metals as follows: (1) It is soluble in sodium hypochlorite (Labarraque's Solution). (2) If the lower part of the tube is cut off, and the sublimate heated while the tube is held in an inclined position, the arsenic is volatilized, and oxidized to arsenious oxide, which condenses in the form of octahedral crystals in the upper and cool part of the tube. This oxidation of arsenic is attended with the characteristic garlicky odor.

If arsenic is dissolved, by the aid of heat, in strong nitric acid, and the solution evaporated to dryness, a white residue of arsenic acid is obtained. This is soluble in water, and the solution thus obtained responds to the tests for arsenic acid; or the solution may be saturated with sulphur dioxide, the excess of this gas removed by heat, and the solution then tested for arsenious acid.

Arsenious Oxide. — This is called also arsenious anhydride, arsenious acid, and popularly white arsenic, flour of arsenic, arsenic and ratsbane. It is the substance usually meant when arsenic is spoken of. Medico-legally the most important of the compounds of arsenic. It is occasionally found native, and is formed artificially whenever metallic arsenic is volatilized in contact with the air. The ore from which it is obtained as the principal product is usually arsenical pyrites. It is also obtained as a bye-product in the roasting of arsenical ores of copper, tin, cobalt and nickel. The ores are roasted in furnaces, and the vapors of white arsenic conducted into large chambers in which they are condensed. The crude product is refined by subsequent resublimations. It is manufactured chiefly in the mining districts of Germany, and in Cornwall and Devonshire in England.

Arsenious oxide is a white solid, occurring in two crystalline forms and in the amorphous state. The amorphous, known also as vitreous or glassy arsenic, is formed when the vapor condenses on a surface whose temperature is but little below the volatilizing point of the oxide, so that before solidifying it passes through the semi-fluid state. It is colorless and transparent when first prepared, but gradually changes into an opaque porcelain-like mass. This change has been attributed to the passage from the amorphous to the crystalline state.

The *octahedral* variety is produced by sublimation when the vapor is cooled rapidly, so that it solidifies at once without passing through the semi-fluid state; also when hot saturated solutions are allowed to cool.

Right rhombic prisms, isomorphous with native oxide of antimony, are occasionally obtained by sublimation; also when a boiling saturated solution of the oxide in potassium hydrate is allowed to cool (Pasteur).

As met with in commerce, powdered arsenic examined microscopically is sometimes found to consist wholly of amorphous fragments of varying size, being prepared by grinding the large masses. At other times it consists chiefly of octahedral crystals varying in size from $\frac{1}{250}$ to $\frac{1}{500}$ of an inch in diameter, usually containing at the same time more or less fine dust and fragments produced by the breaking up of the crystals in the grinding process to

which the crystalline arsenic is subjected before it is put on the market. Hence the microscopical character of the powder *may* enable one to say with tolerable certainty that a certain sample was not derived from a certain source. The factors which we may avail ourselves of in such a comparison of samples, are the crystalline or non-crystalline character of the powder, the prevailing size of the crystals or fragments, the proportion of crystals to amorphous matter, to some extent perhaps the lustre and markings of the crystals, and the presence or absence of foreign matters (the presence of charcoal, for instance, suggesting "Rough on Rats"). Microscopical examination does not, however, enable one to say that a given sample was derived from a given source; though we may say that one sample resembles another, and *may* have been originally a part of it. It should be borne in mind in comparing different samples that the characters of the substance may be materially modified by immersion in a liquid, as the contents of the stomach and articles of food and drink (smaller fragments dissolved, crystals rounded off, etc.).

White arsenic is practically destitute of taste, though at times a sweet, rough, astringent or metallic taste has been described. Its specific gravity is about 3.7, that of the vitreous variety apparently a little higher than that of the octahedral. It volatilizes at about 200° C. The vapor is colorless and odorless and condenses again on a cool surface in the form of octahedral crystals. The solubility of white arsenic in water varies with the conditions. It is, other things being equal, more soluble in hot water than in cold. The solubility, according to Wormley, depends chiefly upon the following circumstances: (1) The physical state of the oxide; (2) the relative proportions of the oxide and water present; (3) the time they have been in contact; (4) the temperature of the mixture; (5) if the mixture has been boiled, the length of time the boiling was continued; (6) the time that has elapsed since the mixture was heated. Wormley's experiments show that one part of the oxide may be dissolved in from 6.72 to 810 parts of water. The vitreous is usually considered to be more soluble than the crystalline variety; but Wormley finds that while under one set of conditions this may be true, under another the reverse may be true. Most experiments show that the solubility is more or less diminished by the presence of organic matter; but probably all liquids which are used as foods or beverages, such as milk, tea, coffee, wines and other alcoholic liquors, may hold in solution, in the quantity in which they would ordinarily be taken into the stomach, a poisonous dose of arsenic. Very large quantities may be held in suspension in thick or mucilaginous liquids, and thus taken into the system unperceived.

White arsenic, although quite heavy, has the peculiar property of floating on water in part, whether the arsenic is added to the water or the reverse. The floating particles frequently unite to form spheres enclosing a bubble of air and persistently refuse to mix with the water. Frequently the portion which sinks presents the same spherical appearance which may persist for a long time, and which is so characteristic as to attract attention. Arsenic will thus float on water for months even if the liquid is occasionally agitated.

White arsenic is more soluble in water acidulated with hydrochloric acid than in water alone. It is very soluble in the fixed alkaline hydrates, less soluble in ammonium hydrate. By nitric acid it is dissolved and oxidized to arsenic acid. White arsenic is used largely for the preparation of other compounds of arsenic, as a mordant, as an antiseptic, to some extent in medicine, for the extermination of vermin, and for other minor purposes. Among vermin exterminators, "Rough on Rats" is a mixture of white arsenic and charcoal; the "Buffalo Carpet Bug Annihilator" contains white arsenic as its poisonous ingredient. Some fly-waters are solutions of this substance or alkaline arsenites in water sweetened with sugar.

Analysis.—The recognition of solid arsenious oxide presents no difficulties. Its crystalline form (octahedra or modifications of octahedra) is very characteristic. Heated on charcoal in the reducing blowpipe flame it is volatilized in the form of white vapors, with the emission of a garlic-like odor. In this experiment, the oxide is first reduced by the carbon to metallic arsenic, which is in turn reoxidized in the air to arsenious oxide. Heated in a reduction tube it volatilizes without fusing, and recondenses in the cool part of the tube in the form of octahedral crystals, or crystals which are modifications of octahedra. Other white powders furnish crystalline sublimates, but most of these melt before volatilizing, and none of them condense in octahedral crystals. The reduction test for arsenic is one of the most valuable tests and is thus performed. Place a bit of arsenious oxide in the closed end of a narrow reduction tube, and a little distance above this place a piece of recently ignited charcoal. First heat the charcoal to redness, and then the oxide, keeping the charcoal at the same time hot. The oxide is volatilized and in passing over the hot charcoal loses its oxygen and is deposited in the cool part of the tube above as a sublimate of metallic arsenic, the characters of which have been described. This reduction may also be effected by a dry mixture of sodium carbonate and potassium cyanide, or by potassium ferrocyanide which has been previously dried at 100° C.

Pure aqueous solutions of arsenious oxide have a feebly acid reaction. If a drop of such a solution is allowed to evaporate spontaneously on a glass slide, the oxide is left in the form of octahedral crystals. The residue thus obtained by evaporation may be tested as above described. The most important tests for arsenious acid in solution are the following: (1) the ammonio-silver nitrate test; (2) the ammonio-copper sulphate test; (3) the sulphuretted hydrogen test; (4) Reinsch's test; (5) Marsh's test. Most of these tests require a skill in manipulation possessed only by the trained chemist, and all of them are subject to certain fallacies which can be avoided only by a thorough knowledge of the chemical properties not only of the compounds of arsenic, but of those of certain other elements. A satisfactory description of them cannot therefore be given in this paper. Of the tests mentioned, Marsh's test is the most important as well as the most delicate; while Reinsch's test is the only one applicable in the presence of organic matter. In the performance of the latter test it is important to remember that both metallic

copper and hydrochloric acid frequently contain traces of arsenic. The purity of these reagents should therefore be first determined.

Arsenites. — These are compounds of arsenious acid with metals. The alkaline arsenites are at times sources of poisoning. Potassium arsenite which is used in medicine under the name of "Fowler's Solution" is the most important of these. Both potassium and sodium arsenites are used considerably in solution and in the form of a soap by taxidermists. They are white, non-volatile, very soluble compounds, and respond to all the reactions for arsenious acid, with the exception of the sublimation test, and to those for the constituent metals. Fowler's Solution is further characterized by its odor and color.

Aceto-arsenite of copper (Paris green or Schweinfurth green), is used largely as a pigment, and for the purpose of killing the potato-bug. Owing to the ease with which it can be obtained, it has given rise to numerous cases of accidental and suicidal poisoning. It is characterized by a vivid-green color when pure, a paler green when adulterated, as is frequently the case, with chalk or gypsum. Heated in a closed tube it furnishes a sublimate composed of octahedral crystals of arsenious oxide, while a black residue (cupric oxide) remains behind. It is insoluble in water, but wholly soluble, if pure, in ammonium hydrate with formation of a deep blue solution. If this solution is allowed to stand till the excess of ammonia has escaped, and a drop or two of a solution of silver nitrate is then added, a yellow precipitate of silver arsenite is obtained. On systematic analysis it affords the reactions for copper and arsenic.

Arsenic Acid. — This is a very poisonous compound not often met with outside the chemists' laboratory, and not likely to become the object of a medico-legal investigation. It is a white, non-crystalline, deliquescent solid, soluble in water. The solution has an acid reaction. Heated to a red heat in a closed tube it is decomposed into oxygen and arsenious oxide, the latter forming the characteristic sublimate in the cool part of the tube. It is only with great difficulty that it is completely volatilized. It responds to Marsh's test, the reduction test previously described, and Reinsch's test provided the solution is sufficiently acid. There are also special tests for arsenic acid, some of which are important inasmuch as they are made use of for the purpose of estimating arsenic quantitatively.

The arseniates of sodium and potassium are much used, especially the former in the processes of calico printing. They are white, non-volatile, deliquescent salts, soluble in water. They have only rarely given rise to poisoning. They respond to the tests for arsenic acid, as well as to those for the constituent metals.

Sulphides of Arsenic. — Arsenic disulphide occurs native as realgar. It crystallizes in more or less translucent prisms which have an orange-yellow color and a resinous lustre. The commercial product is an artificial sulphide made by subliming a mixture of arsenical pyrites and iron pyrites. The product is then melted with arsenic or sulphur, according to the shade of color

desired. This artificial product is amorphous, red and opaque. Its composition is variable. It usually contains free arsenious oxide. It was formerly used as a pigment. Mixed with lime it is employed in tanning for removing the hair from skins. It is a constituent of Indian or white-fire, which is used for pyrotechnical purposes.

Arsenic trisulphide, which is known under the name of orpiment or yellow sulphide of arsenic, occurs native in translucent, lemon-yellow colored prisms. It is obtained pure by passing sulphuretted hydrogen gas through a solution of arsenious acid or of an arsenite acidified with hydrochloric acid. This compound is occasionally found in the œsophagus, stomach, or intestines of persons poisoned with arsenic, as a result of the sulphuretted hydrogen, formed during decomposition, upon arsenic present in these organs. The commercial product is prepared by subliming pulverized arsenious oxide and sulphur in the proper proportions. It is, as thus prepared, a mixture of arsenious oxide and sulphide, and is very poisonous by reason of the former constituent. It was formerly much used as a pigment under the name of King's yellow, but is rarely used as such at the present time. It is used in calico printing and dyeing, especially for the reduction of indigo; mixed with lime it is used in India as a depilatory.

The sulphides of arsenic are insoluble in water (any oxide present, however, is dissolved by water). They are soluble in alkaline hydrates and are reprecipitated from these solutions by an excess of acid. They are converted by nitric acid to soluble arsenic acid. They are distinguished from nearly all red or yellow inorganic compounds by their volatility. They respond to the reduction test for arsenic (with sodium carbonate and potassium cyanide) and are thus distinguished from all red or yellow colored compounds.

Arseniuretted Hydrogen. — This is a colorless gas with a peculiar and extremely disagreeable odor. It is the most poisonous compound of arsenic. Prepared by dissolving any compound of arsenic with a metal in dilute hydrochloric or sulphuric acid; or by bringing any soluble compound of arsenic in contact with nascent hydrogen. It is of especial importance in its chemical relations, since upon its formation is based Marsh's test for arsenic. Poisoning by arseniuretted hydrogen has hitherto been accidental: either the result of inhaling the gas in the laboratory, or of inhaling hydrogen made with arsenical zinc or arsenical sulphuric acid; or of inhaling the gases evolved in certain manufacturing or mining processes.

MEMORANDA RELATING TO ORGANS AND SUBSTANCES SENT FOR ANALYSIS.

The organs which should be submitted to chemical analysis in a case of suspected arsenical poisoning are the following: stomach and intestines with their contents, liver, kidneys, spleen, brain and heart. Any urine remaining in the bladder should be saved, since it is with the urine chiefly that arsenic is eliminated. Medicines administered during life, suspicious chemicals, suspected articles of food and drink, the vomitus, fæces and urine, if any, voided during the attack, must also be secured. At the autopsy the organs should be

placed for examination upon plates which have been thoroughly cleaned by the medical examiner himself. Special care should be taken that they are not brought in contact with undertaker's paraphernalia on account of the danger of absorbing some disinfecting fluid containing arsenic. If the stomach and intestines are opened, care should be taken that the contents are not lost, since the examination of the latter by the chemist is often of great value. If the interior of the stomach or intestines is washed, the wash-water should be saved, for it may contain solid particles of the poison removed from the mucous membrane. The organs should be sent to the chemist in perfectly clean glass jars, each organ in a separate jar, and the latter should be closed with glass and not metallic caps, carefully sealed and labelled by the examiner. They should be sent to the chemist by a messenger, or preferably two messengers, to diminish the danger of loss of identity through the death of a messenger. Above all, they should not be sent unsealed by express since their identity is thereby lost. The organs while in the possession of the examiner or messenger should never be left in any place to which others have access. No preservative should be employed. The use of such complicates the analysis, and renders an analysis of the unused portion of the preservative absolutely essential in case any poison is detected. It is a wise precaution, in cases which are likely to result in a trial for murder, to divide each of the organs and submit the separate portions to two chemists; 1, for the purpose of confirmation of results if such is desired; 2, that in the case of the death of one chemist the results of the analysis may not be lost. A frequent error in cases of suspected poisoning is that of sending the stomach alone for analysis, in the belief that if poison has been administered it must necessarily be detected in the stomach. This is a mistake; for the poison may have been entirely removed from the stomach by vomiting or absorption, so that it can no longer be detected there, while its presence is readily determined in the blood and solid tissues. This is likely to be the case if the patient has survived the administration for many hours. A mistake is sometimes made in sending a small portion of some one organ for analysis. If the amount of poison present is very small, the analysis under such circumstances may be wholly negative. The whole of each organ should be submitted for analysis. The importance of the chemical analysis of the vomitus and urine in cases of suspected arsenical poisoning should never be lost sight of. Arsenic usually provokes violent vomiting, and it may happen that the poison is wholly removed from the stomach so that none can be detected in this organ after death. If the patient survives a week or more, all the poison absorbed may be eliminated, so that after death none can be detected in any of the organs. In such a case the analysis of the vomitus might be of great importance in the way of establishing the fact of poisoning. The examination of the vomitus is further important, since, if the poison has been taken in the solid form, it may enable the chemist to determine the exact compound taken, a fact which cannot be established after the poison has been absorbed, excepting in the case of Paris-green poisoning.

The examination of the urine passed during life is especially important, for the urine is the chief channel of elimination and the detection of arsenic in this secretion is a positive proof that arsenic has been absorbed into the system and is in process of elimination. The examination of the vomitus and urine thus afford the best means of establishing by chemical evidence during the life of the patient the diagnosis of arsenical poisoning.

QUESTIONS LIKELY TO ARISE IN CONNECTION WITH ARSENICAL POISONING.

(1) The question is always asked in trials for murder by poisoning with arsenic, if the quantity detected in the body is sufficient to cause death? the feeling being quite general that the evidence is defective if the answer is in the negative. The arsenic found in the stomach and intestines however, if any, is not the arsenic which has caused death. It is simply that which is left after the absorption of a certain amount, and the loss, in most cases, of a certain amount by vomiting and purging. It, therefore, furnishes no clue to the amount actually taken, which is the more important question. If a large quantity is found in the stomach and intestines, it is, of course, evident that a large quantity must have been taken. But a half-grain detected in the stomach may be the residue from a small or a very large dose. Neither does the quantity extracted from the organs ordinarily submitted to the chemist furnish any definite clue to the actual quantity taken. If several grains are isolated, a large and fatal dose must have been taken. But a small quantity may represent either a relatively small or a relatively large dose. For in the latter case much must have been thrown off by vomiting and purging and thus have escaped absorption; and much may have been removed by elimination if the patient has survived a few days. Moreover, the chemist never isolates all the poison contained in the body, for he subjects to analysis only a small portion of the body, all parts of which, as a rule, contain more or less arsenic. The quantity isolated is, therefore, only a part of that actually taken, and does not necessarily bear any relation to the latter. Finally, we do not know what quantity of arsenic must necessarily be absorbed to cause death. We know what amount is *ordinarily* fatal. But just as this may vary widely in different cases, according to conditions all of which are not understood, so the amount actually necessary to be absorbed to produce a fatal effect probably varies in different cases. In any case the detection of *any* quantity of arsenic over and above insignificant traces is sufficient *chemical* evidence of poisoning. Of course if the amount of arsenic detected is small and *symptoms and appearances are wanting or doubtful*, it may reasonably be suggested that such arsenic may be the remnant of medicinal application, or that it may have been introduced by exposure to arsenical papers or fabrics.

(2) The question is usually asked, "Can you tell if this arsenic was taken into the system before death or introduced after death?" The answer is, "No." The experiments of numerous investigators have proved conclusively that arsenic, injected into the mouth, rectum, and other parts of the body after death, is, by the process of diffusion, carried sooner or later to even the most

remote parts of the body, as the brain. It may be suggested that the symptoms in any given case may aid us in forming an opinion, but it must not be forgotten that there are diseases in which the symptoms closely resemble those of arsenical poisoning.

Professor Reese has suggested that the detection of arsenic in the urine might be regarded as evidence of ante-mortem poisoning, as it is hardly probable that arsenic introduced after death would percolate through the coats of the bladder so as to contaminate the urine. But Dr. Miller shows that arsenic introduced after death into the stomach so diffuses itself as to be detected after a few days not only in the various solid organs of the body but even in the urine. Hence we cannot say from a chemical analysis that the arsenic was not introduced after death. We can *sometimes*, but not always, say (from the quantity found, if large, the distribution, or other circumstances), that it was introduced after death.

The question of the post-mortem diffusion of arsenic derives its importance largely from the practice prevailing among undertakers of injecting into various parts of the body shortly after death embalming fluids most of which contain arsenic as one of the ingredients. This practice is one which must occasionally result in defeating the ends of justice, and its regulation by legislation seems to me highly desirable.

(3) If the body has been exhumed, the chemist is usually asked if the arsenic found could not have had its origin in the soil which at times contains arsenic. It has been satisfactorily demonstrated, however, that arsenic exists in the soil in a form insoluble in water probably in combination with iron. Schlagdenhauffen and Garnier[4] have further shown that if an aqueous solution of any compound of arsenic is left in contact with a clayey soil containing lime or iron at the ordinary temperature, the arsenic is gradually converted into insoluble compounds which are retained by the soil. Any arsenical compound introduced into such a soil, and subjected to continual infiltration of rain, if originally insoluble, remains insoluble: but if soluble, it gradually becomes insoluble, and at a depth of 0.6 to 0.9 m. from the point at which the arsenic is introduced, or no arsenic can be detected in the infiltered water, even after fourteen months.

With ordinary precautions, therefore, in conducting an exhumation the question cannot become a source of embarrassment so long as the coffin remains sound. If the coffin is so far decomposed that the soil has come in contact with the remains, it is, of course, possible that *traces* of arsenic may be accounted for in this manner provided the soil is an arsenical one. To meet the objection it is important in cases of exhumation that a sample of the soil above the coffin be submitted to the chemist with the organs for analysis.

(4) How long after death can arsenic be detected? If present at the time of death it may be detected for many years; fifteen or twenty at least. The possibility of the loss of arsenic after long periods must, however, be recognized. Hamburg mixed one gram of arsenic oxide with some finely divided organs and placed the mixture in a flask. He found that the gases evolved

[4] Comptes Rendus, 100. 1388.

during putrefaction contained an abundance of arsenic. At the end of nine and one-half years the amount of arsenic present corresponded to only 0.551 gram arsenious oxide.[5] The odor of arseniuretted hydrogen or other volatile arsenical compounds evolved from putrefying organic mixtures containing arsenious oxide has been frequently noticed by chemists. A similar odor is frequently noticed when the bodies of those who have been poisoned by arsenic many months or years before, are first opened. This odor is not, however, *necessarily* indicative of arsenic, for it is sometimes noticeable when no arsenic can be detected.

(5) The effect of arsenic on the putrefactive process may be inquired into. In some cases of arsenical poisoning the body has been found remarkably well-preserved many years after death. To what extent this is due to arsenic is uncertain; for in some cases of arsenical poisoning decomposition has proceeded very rapidly, while the body has been found very well preserved in cases of death from other causes. We cannot therefore say that the preservation of the body in any given case is due to arsenic.

(6) May death have been caused by arsenic, and yet none be detected in the body? Yes. Death may take place within a few hours and none be detected in the stomach or intestines, on account of removal by vomiting, purging and absorption. It may be found in the stomach and intestines and not in any of the organs of the body; or it may be absent from one organ and yet present in other organs. Or it may early disappear from all. Wormley found only $\frac{1}{100}$ of a grain of arsenic in the liver of a dog that had been under its influence for eight days and then died from its effects.[6] Casper found arsenic both in the solid state and in solution in the contents of the stomach in a case in which death took place in twenty-four hours, but neither the blood nor the liver revealed its presence (quoted by Wormley). Grohe and Mosler record a case in which a child two years old died in seventeen hours from the effects of a green arsenical paint. Arsenic was found in the vomited matters, but not even a trace in the contents of the stomach and intestines, or in the spleen, liver, bile or kidneys (also quoted by Wormley). In the majority of cases of acute poisoning, however, arsenic may be detected in all the organs and tissues of the body: the liver usually containing the largest quantity of absorbed arsenic.

(7) In what time is arsenic eliminated? Elimination commences early and takes place chiefly through the kidneys: in part, through the glands of the skin, the mucous membrane of the alimentary canal, and in the bile, saliva and tears. The time required for complete elimination appears to be, as a rule, about fourteen days; in some cases a longer period is required. Arsenic has been detected in the urine as late as six and one-half weeks after the last administration. Ludwig detected arsenic in the liver of a dog forty days after its administration. On the other hand, cases are reported in which death took place within a few days after taking the poison, and yet none could be detected in any part of the body.

[5] Zeitschrift für Analytische Chemie, 1887, p. 758.
[6] Micro-Chemistry of Poisons. Second edition, p. 312.

THE SOMERVILLE CASES OF ARSENICAL POISONING.[1]

BY T. M. DURELL, M.D.

On the fourth day of August, 1886, William J. Robinson, a strong young man of twenty-two years, was struck on the back of the neck by an empty soap box falling upon him. He went home and told his mother of this injury; she prepared his dinner, which he ate; and almost immediately he complained of pain in his head, and began to vomit. He returned to his work, but vomited several times during the afternoon, and complained of headache. The next day he was much worse; he had severe frontal headache and sighing respiration; his face was flushed, his eyes injected; pulse 90; temperature, 100°. The heart's action was weak. This condition of things was found by Dr. E. L. White on his first visit. The story of the accident was told, but this did not seem to be enough to account for the condition of the patient.

August 6th. The headache was less severe and the vomiting less frequent. There was a slight papular eruption over the surface of the body.

August 7th, 7.30 P. M. Vomiting constantly, excessive thirst, burning pain in the throat and stomach, and severe diarrhœa; the headache had disappeared; the face was red, and the eyes injected. The mind was clear.

August 8th. The above symptoms continued during the day, with more eruption.

August 9th. The face was flushed; the eyes were injected and jaundiced; the respiration was sighing; the temperature was 100° and the pulse 104. There was burning pain in the fauces and stomach, with great thirst; the liver and spleen were enlarged. Up to this time, no vomitus or urine could be obtained, as they were thrown away immediately; but during the visit the patient vomited, and the vomitus was taken by the physician, and sent to Dr. Wood for analysis. Crystals of white arsenic were found. In the afternoon there was some vomiting, and the diarrhœa continued; but the patient was rather more comfortable. Mrs. Robinson was very anxious to know what had been done with the vomitus.

August 10th, 9 A. M. Patient better. Temperature, normal; pulse, 100, rather weak; respiration, 24, sighing, but not as much so as before; less diarrhœa and vomiting. At 8.30 P. M. the pulse was 112, weak. Severe nosebleed during the day, and great pain in the throat.

[1] Read before the Massachusetts Medico-Legal Society, February 6, 1889.

August 11th. Much worse; liver and spleen more enlarged; pulse 120, and weak. There were many patches of ulceration in the mouth, inside of the lips and throat; throat very red; body jaundiced; eyes bloodshot and jaundiced. There was a papular eczema over the surface of the body and limbs. The abdomen was swollen. The mind was wandering at times. The patient was very restless. At 5 P. M., pulse, 134; and respiration, 36; no second sound of heart; the skin was cold and clammy.[2]

The patient died early in the morning of the 12th, and I at once took charge of the body and had it removed; and at 1 P. M. (nine hours after the death), I made an autopsy in the presence of Drs. A. F. Holt and J. L. Hildreth, as witnesses, and found the following appearances:

Rigor mortis was fairly well marked. The pupils were moderately dilated. The dependent parts of the body were of a dark bluish color; other parts of the body and limbs were covered with bluish spots, irregular in outline, varying in size from half an inch to several inches in diameter. Scattered over the body were some blackish spots, varying in size from a pin's head to that of a pea (ecchymoses). Careful inspection revealed no external marks or signs of violence. The inside of the mouth and the tongue were covered with deep ulcerations. On making the cut to open the great cavities, the muscles were seen to be of a bright red color, and those of the chest were well developed. There was about six ounces of straw-colored fluid in the abdominal cavity; the peritoneum was everywhere clear and glistening; the intestines were distended with gas.

The liver was enormously enlarged, nearly filling the abdominal cavity, and was of a bright yellow color.

There were about eight ounces of dark, bloody fluid in the left pleural cavity; a little less, of a lighter color, in the right.

Both lungs were adherent at the top and back. In other parts, the pleuræ were clear and glistening.

There was about two ounces of straw-colored fluid in the pericardial sac. The pericardium was clear and glistening on its inner surface. The heart was about the size of the right fist. A small quantity of dark fluid blood flowed from the cut vessels in removing the organ. There was a little fluid blood in the right side of the heart, and a very small well-organized clot. The auriculo-ventricular opening admitted three fingers. The left side of the heart was empty. The auriculo-ventricular opening of this side admitted two fingers. All of the valves of the organ were normal in appearance, its cavities of normal size, and its walls were of normal thickness. The muscular fibre of the organ was of a red color, and slightly soft.

The left lung was generally of a dark red color; the vessels were full of blood; the bronchi were filled with frothy mucus; a quantity of dark bloody fluid could be squeezed from the cut surface. The right lung was generally in the same condition as the left, with the exception that it was of a lighter

[2] For the above history, I am indebted to the kindness of Dr. E. L. White, as I did not see the patient till August 11th.

color in the upper portions. The trachea contained a quantity of frothy mucus. The œsophagus was normal.

The spleen was enlarged to twice its normal size, and was of a bluish color; on section nothing abnormal was found. The left kidney was a little enlarged, of a uniform bluish color; its capsule was adherent, tearing the tissues on its removal. Section showed the blood-vessels to be moderately full of fluid blood; the cortical portion was of a reddish-gray color, normal in thickness; the tubular portion was of a bluish color, and the vessels in it could be seen as red lines. The right kidney was slightly larger than the left, and like it, with the exception that the cortical portion was of a grayish-yellow color, and the vessels could be seen in it as well as in the tubular portion. The ureters and bladder were normal; the latter contained about four ounces of urine.

The large intestines were distended with gas, and contained a yellowish-green material, as well as some small semi-solid portions of fæcal matter. There were a few spots, especially in the lower part, that were red, and the vessels were injected about these. The spots were about the size a five-cent piece.

The small intestines contained a quantity of yellow, gelatinous material; the mucous membrane was red in spots. The mucous membrane of the duodenum was of a red color and the rugæ were almost black.

The stomach was dilated to the capacity of a quart, and contained about half a pint of dirty, greenish liquid. Its external coat was of a grayish color except in the dependent parts, where it was red. The mucous membrane was red in patches, and scattered over a greater part of it were a large number of small ecchymoses. The vessels were injected.

The liver was of a striking yellow color, reddened in spots and greatly enlarged. The cut surface was of the same yellow color, and the acini could not be made out. The vessels were partly filled with fluid blood. The gall-bladder was filled with a reddish watery pile; its duct was free. The pancreas was normal in appearance.

No blood flowed from the cut vessels of the scalp. The skull was normal in thickness and appearance. The dura mater was of normal thickness, translucent and glistening on its inner surface. The pia was everywhere clear and glistening, its vessels were moderately full of fluid blood, particularly on the left side; those of the base were empty. Careful section of the brain and great ganglia showed them to be everywhere normal in appearance.

The organs were carefully sealed and delivered to Prof. E. S. Wood and Dr. Charles Harrington for analysis. Both of the chemists found large amounts of arsenic in the organs delivered.

This case was one of a series of cases of poisoning by the use of arsenic, — a series unequalled, I believe, in the history of crime. There are many cases on record where a woman has poisoned several persons, either from hatred or for some other motive; but for a mother to poison her own children is, I believe, without parallel.

Mrs. Robinson's career in arsenical poisoning began in Chelsea, thirteen

years ago. At that time, Joseph Field, who married Mr. Robinson's sister, became attached to Mrs. Robinson and left his family and went to board with her. He had a large amount of money and government bonds, which he kept in a box in his room. Shortly after he went to board with Mrs. Robinson he was taken sick with symptoms of poisoning, and died. After his death no trace of the money or bonds was ever found; but Mrs. Robinson went to Dr. Bean, who attended Field, and asked him how she could get money for a government bond which she had. At that time the doctor thought that Mr. Robinson had poisoned Field from jealousy.

Later, the Robinson family went to live in a house owned and occupied by Oliver Sleeper and his wife. While there Mrs. Sleeper died, and Oliver took his meals with the Robinsons. Sleeper received something over $10,000 in money, and carried it home with him; and directly after this he was taken sick and died. His sickness was due to slow poisoning; and arsenic was found in his remains when exhumed. When the administrator took charge of his effects the money was gone. Mrs. Robinson nursed him during his sickness. Sleeper died August 10, 1881.

July 23, 1882, Moses Robinson (Mrs. Robinson's husband), died after an illness of six days. The prominent symptoms were vomiting and diarrhœa. Shortly before this, Robinson made application for insurance to the New England Relief Association for $2,000 which was made payable to his wife. Just before his sickness Mrs. Robinson went and asked if his insurance papers were all right. She brought suit to recover the insurance but failed to recover for some technicality. Arsenic was found in his body.

The Freeman family consisted of four persons, Mr. and Mrs. Freeman and two children. Mrs. Freeman was a sister of Mrs. Robinson. Prince Arthur Freeman had his life insured in favor of his wife, and this wife, Annie E. Freeman, was taken sick with symptoms of poisoning, and died February 26, 1885. Mrs. Robinson nursed her during her sickness. Arsenic was found in her body.

The baby, Elizabeth Bell, died April 16, 1885, Mrs. Robinson being her nurse. No arsenic was found in this case, although the baby was nursing at the time of the mother's sickness.

After the death of Mrs. Freeman, Mrs. Robinson persuaded Freeman to come and live with her; and the insurance policy was made payable to her, the idea being that, should anything happen to Freeman, Mrs. Robinson might have money to bring up the boy. Freeman died June 27, 1885, after an illness of six days, the symptoms were those of poisoning, and arsenic was found in his body.

Lizzie A. Robinson, a daughter of Sarah Jane, died at Somerville on February 22, 1886, after an illness of four weeks and five days. This illness commenced with an attack of acute rheumatism; but, during the course of the disease, she developed symptoms of acute Bright's disease. She also had severe vomiting and diarrhœa, and finally died, according to the death certificate, of acute Bright's disease. The physician who attended her made every

effort to secure an autopsy, but her mother would not allow it. She was insured for $2,000. Arsenic was found in her body.

Thomas A. Freeman (son of Prince A.), living at Mrs. Robinson's, died July 23, 1886, after a very obscure illness. Arsenic was found in his remains. The motive in this case was to get rid of the boy, so that she might use the whole insurance money of the father.

Next came the case of William J. Robinson, who died August 12, 1886. He was insured for $2,000 in favor of his mother.

There was the same method employed in all these cases; the plan being to call in some physician for a comparatively slight sickness, and then administer the arsenic. In all of the cases physicians of good standing were called, and before they realized what had happened, the patient was dead. The result was, that, in a few years, nine persons died under the care of Mrs. Robinson; and in all of the cases except Field and the baby, arsenic was found in large quantities after death. In all of these cases the physicians who attended the various patients have made statements of the symptoms of their patients, and all of these statements correspond with the history of arsenical poisoning. One of the most remarkable things about these cases is the skill which was used by Mrs. Robinson in administering the poison; and this very skill would lead one to think that some one familiar with the properties and uses of arsenic must have been associated with her.

Mrs. Robinson was tried for the murder of her son, William J. Robinson, but the jury failed to agree on a verdict. Subsequently she was tried and convicted for the murder of her sister and family.

ARSENIC IN THE COURTS.[1]

BY F. A. HARRIS, M.D.,
Medical Examiner for Suffolk County.

INASMUCH as arsenic is one of the best known of the deadly poisons, and as it is also one of the most easily obtained, owing to its extensive domestic use in the form of what is popularly known as "Rough on Rats," and its more extensive use in agriculture in the form of Paris green, it is not strange that by far the largest number of suicides by poison should owe their success to the ingestion of this particular one.

As white arsenic and Fowler's solution are practically free from taste or odor, and are readily administered in food or drink without liability to attract the attention of the victim at the time, it is not surprising that this drug has been a favorite with those contemplating secret murder.

That its use for this purpose is constantly diminishing is wholly due to the gradually-increasing knowledge on the part of the general public that it is one of the homicidal drugs most certain of detection; and as modern chemistry has succeeded in removing much if not all of the mists and fogs which surrounded trials in past generations, the risk in the use of this poison has become so great that trials for murder with arsenic are becoming rarer year by year.

Yet, from time to time such cases do occur; and when they do, although the management of the trial must be wholly in the hands of the gentlemen of the legal profession, still they must rely largely upon the advice and assistance of the doctor. It is true, even if he be a medical examiner, his position is that of a witness only to tell what facts he knows, and such opinions as he can fortify; but he must also assist in clearing away any doubts which counsel eager in the defence of their client may seek to arouse in the minds of the jury while confining his own evidence within strict lines of impartial demonstration of scientific fact. The chain of proof in a trial for murder by arsenic will naturally include —

(1) The death and the cause of the death, namely, that it was arsenic in some form, and from nothing else; or, if from something else, directly, how far the arsenical poisoning was contributory thereto.

(2) That such death was the result of homicide, and not of suicide or accident.

(3) That the accused was the person who administered the drug, — this question involving motive, opportunity to administer, possession of the drug

[1] Read by title before the Massachusetts Medico-Legal Society, October 3, 1888.

anterior to the crime, and other matters still more closely within the province of the lawyer.

It is with the first part of this chain of proof with which the doctor, and especially the medical examiner, has to do, and with the second part only to a limited extent. As in ordinary warfare inventions for defence have closely followed inventions for greater destruction, so in the legal warfare of murder trials, the skill of defence has been assisted by experience and the knowledge of increased means of medical proof, and to-day the closest attention to detail is necessary on the part of the physician. Formerly it would have answered every purpose to have demonstrated the presence of arsenic within the stomach. To-day such proof would be insufficient, as the presence of unabsorbed arsenic is consistent with a continuance of life. To-day the medical evidence must demonstrate not only the presence of the drug, but also, generally, that the drug has been absorbed, and also the method by which it has destroyed life, whether by the violent inflammation of the stomach and intestines coupled with the exhaustion of the violent vomiting and purging, or whether, at a later period, by the destructive effect of the absorbed drug upon the other viscera, notably the liver and kidneys, by producing fatty degeneration. A chemical examination of the vomitus and the urine voided, while of assistance in a capital trial, has not the importance that it would have in a trial for attempted murder where the victim survived, inasmuch as in such cases the proof of rejected and eliminated arsenic, combined with the history of the symptoms, would be the only proof of arsenic ingested or absorbed. But where death has occurred the pathological changes are so marked that it is not difficult to demonstrate that an irritant poison has been at work, and the chemist is able to demonstrate what that irritant was.

The medical witness must be prepared to demonstrate clearly the pathological changes. No jury would be warranted in finding a verdict of guilty in a case where, although chemistry might show a small amount of arsenic in the system, there was still no evidence that such arsenic had produced any deleterious effects upon the organism. This is of especial importance when the liability to error in attributing minute amounts of arsenic after Marsh's test to the presence of such drug in the body at time of death is considered. A still graver error is liable to result unless the utmost accuracy is observed in weighing the amount of organs delivered to the chemist, and also the amount retained for examination in case of accident to the first portions; for an error of little moment of itself, when multiplied for the purpose of forming an estimate of the whole amount in the body, would have a possible fatal effect on the life of the accused.

This was notably exemplified in the *cause célèbre* at New Haven, where two young men were put on trial for the murder by arsenic of one Jennie Cramer. Here, though *a priori*, from the place where the body was found, and from all the pathological conditions, the case was one clearly of death from drowning, as was later demonstrated to the satisfaction of the jury, the Government endeavored to establish the theory of homicidal arsenic poisoning.

In the report of the post-mortem examination there was absolutely no proof of any deleterious effects of the drug upon the organism; on the contrary, the condition of stomach and bowels showed the absence of either vomiting or purging, and no fatty degeneration of any organs, and no inflammatory action in the stomach. The chemist who analyzed portions of the organs and of the muscles, found, by Marsh's test, minute quantities of arsenic.

It is, of course, a question if there was any arsenic in the body during life; but when it was put in evidence that he had *about* one-half of the liver and *about* so much of other organs, and the minute fractions of a grain of arsenic in these *abouts* were multiplied, as if they were exact amounts, by the weight of the body, to produce an estimate of a little less than two grains in the whole body, a very dangerous plan was adopted, when human life was at stake.

This, however, belongs rather to the province of the chemical expert than the pathologist. It ought not to be a matter of great difficulty to demonstrate the changes produced by an irritant poison, and to undergo the ordeal of a cross-examination, when the poison has been the sole cause of death. When disease is present, or organic changes in various organs, it may not be so easy to make clear to a jury just how much the arsenic had to do with the death, especially if the quantity is small, and the exhaustion from the irritant action is the chief factor. Each case must be considered and treated of itself; and that evidence will have the greatest weight with the jury which does not claim too much, or assume infallibility. The present state of medical expert testimony in the courts would undoubtedly ensure a number of witnesses to controvert any extreme position, no matter how fully convinced the examining physician might be of the soundness of his theories.

In all trials where the results of chemical analysis show only a small amount of arsenic, the theory of accidental admixture after death will be urged, especially in those long buried. To-day not much weight, if any at all, is given to claims that the body absorbed arsenic from the soil in which it lay. The physician who makes the autopsy has only to demonstrate the caution he observed to prevent admixture from anything on his table or instruments, or the use of unclean dishes or jars, and leave to the chemist the demonstration of the impossibility of any artificial accidental admixture while the organs were in his charge. One thing is absolutely conclusive. No pathological change can occur after death. If the pathological changes of arsenic poisoning are to be observed in the body, it is entirely clear that the arsenic was ingested during life.

Most of the embalming fluids, so-called, contain arsenic; and it is often the case that the body has been injected before the cause of death is suspected. This need give the medical examiner no trouble; for the utter worthlessness of any pathological or chemical examination, as far as the demonstration of arsenic poisoning is concerned, is so clear that no prosecuting officer would proceed at all in the case, if the result depended on such examination. There were some such cases involved in the late trial of Mrs. Robinson; but they were not regarded as factors, either by the lawyers or physicians.

The question of accident, suicide, or homicide, is one to be determined by collateral evidence, and really to be decided by the jury. The form in which the drug was ingested, the quantity and time and place, social surroundings and mental conditions, may all have weight in arriving at a just conclusion; and the physician can be rather of service to counsel before trial in aiding him to a proper theory, than in actual testimony upon the stand.

The other questions occurring in arsenic trials are wholly within the domain of law, and so not within the scope of a paper before this Society.

A CASE OF ACCIDENTAL DROWNING.[1]

BY FREDERICK WINSOR, M.D., WINCHESTER, MASS.

GENTLEMEN OF THE MASSACHUSETTS MEDICO-LEGAL SOCIETY: — An address from the retiring president would doubtless be received kindly and patiently by the members before me; but the present incumbent has nothing to offer which is worthy to be called an address, and he is unwilling to waste your time with perfunctory speech. There are, however, a few points to which he will venture to call your attention.

Our attempt to obtain a change in the law regulating expert testimony, by which it would gain in dignity and in value and greatly advance the purposes of justice, has failed — failed for the present only. The reform we seek must come, for it is in the interest of good sense and truth. What is so plain to the medical profession must gradually become evident to the majority of the bar and the bench, who now fail to see that it would help them, as well as us and the whole community. Let us bide our time, and by and by press the reform again, leaving the initiative to those members of the bar whose eyes have been opened.

Our Society has reached a stage of development when it needs, not so much fresh rules and maxims, as the faithful use and practice of those with which it has supplied itself. "The Law of Medical Examiners" has been sufficiently elucidated and expounded. When to make a view, and when to refuse; when to ask permission to make an autopsy; how to conduct and record the autopsy, with the adjuncts, it may be, of chemical and microscopical expert investigation; to keep to *our* function, and leave to the court and the lawyer what belongs to them, — the *theory* of all these matters has been made plain to each of us, and admirable illustrations of its application to practice have been furnished in papers with which our publications are enriched. Familiarity with such applications is, perhaps, what is most needed by the individual examiner; but what the Society most needs is the readiness and habit on the part of every member to prepare for report and to present at our meetings such of his cases as are unusual and instructive.

It is obvious that such a habit would conduce greatly to accuracy and thoroughness in making views and autopsies; while it is almost essential to the well-being of this Society, which languishes to-day for want of just such nourishment.

Those of us whose cases are few — too few to make us as familiar as we

[1] Read before the Massachusetts Medico-Legal Society, June, 1888.

feel that the medical-examiner should be with the application of the instructions we have received — are no doubt deterred from reporting cases by the suspicion that what is to us novel or puzzling, may be to our more experienced and accomplished associates an old or a trifling and tedious matter. But this risk must be encountered by every one who cares to learn; and it is in the hope of drawing some better instruction from others that I submit to this meeting the following report of a case.

The following case was one in which the decision of the medical-examiner was questioned, and an inquest was held:

June 23, 1884, at 7.45 P.M., I was summoned to Woburn, to view the body of a woman which had been found, three and a half hours earlier, floating in shallow water on the shore of Horn Pond, near a place known as the "Swimming-Hole," distant about a quarter of a mile from any road or dwelling.

The officers who took the body from the water reported that they found it floating face down in water about two feet deep; the back, hips, and back of one leg were above water, the head and arms were more deeply submerged, the forearms and hands resting on the bottom (which was of sand and pebbles). Close by, six or eight feet from the water's edge, her clothing lay in an orderly pile. The ground in the neighborhood was not trampled, and showed no signs of any struggle.

I found at the undertaker's room the body of a middle-aged, well-nourished woman, naked, cold and rigid. The face was not livid, and but little swollen. The eyelids were closed, the face placid. The teeth were clenched, and the tip of the tongue was between them, but not bleeding and not protruded between the lips. About the mouth and nostrils was a little blood, which came from cuts and scratches near by, — one on the right cheek, near the nose; several on the lower lip; all in the same general horizontal line, and all superficial. The tragus of the right ear was also slightly cut or scratched, and smeared a little with blood from the scratch. There was no froth at the mouth or nostrils. The right hand was clenched; the left partly so. There was cutis anserina on the front of the body. On the back of the trunk a few spots of hypostatic discoloration were seen. There was no other bruise, wound, or mark on the body.

Palpation showed that the womb was not enlarged; percussion, that the thorax was normally resonant.

From the husband I learned that he last saw the woman alive at 5.50 A. M., of the same day, when he left home for his work, she having cheerfully got him a good breakfast and seeming well. Returning at noon, he did not find her, and was told by his children (her step-children) that they had not seen her since they rose (about 7 A. M.). He and they supposed that she had gone — as she sometimes went — to visit her relatives half a mile away and nearer the pond. By the children I was told that she had several times said "she should like to have a bathe in Horn Pond." None of her immediate neighbors saw her leave home that morning.

She was well known in Woburn, and generally understood to be of inferior mind, and to have no delicacy of feeling and small sense of decency. I talked with her brother, as well as with her husband, and could not learn that she had ever been subject to "fits," or had spoken of suicide. I did learn, however, that she had "queer times," when she was very absent-minded, red in the face, and not well aware of what was going on, — although she attended fairly to her housework at such times.

The other relations were Protestants and of New England descent. Her husband was Irish Catholic, and had been forced into the marriage by her swearing him to be the father of her illegitimate child; and they did not live very harmoniously, though there were no stories of violence between them.

Her brothers gave me to understand that they suspected foul play on the part of the husband and his Catholic friends. They propounded vague theories as to her being abducted by night, and drowned, or dropped into the pond after being poisoned.

I saw no reason for asking an autopsy, nor did they call for it; and I reported the case to the District Judge as one of "accidental drowning."

The theory which seemed to me consistent with the observed facts, and with the woman's character and history, is that she was subject to epilepsy of the slighter form; that, under the influence of an approaching attack, she started to bathe in the pond; that by the time she had undressed and entered the water, she became dizzy and unconscious, fell face downward, and smothered with little struggle, perhaps with spasm of the glottis. The very slight scratches on the face and ear might well have been abrasions made by the pebbles on the bottom.

The suspicions of her relations grew with dwelling on the strange death, and they employed two resident physicians to make an autopsy within forty-eight hours. I was not notified of the autopsy, but heard at the inquest their testimony, which was not from notes, but from memory. It was negative, — so far as regards the finding of any appearances to account for the death, — with the exception of an effusion or infiltration of bloody serum (rather insignificant in extent and vaguely described) into the substance of the upper half of the right pectoralis major muscle. There was no ecchymosis or other mark on the overlying integument; no injury of the clavicle or ribs. They found no evidence of poison. Their opinion was that death was not by drowning, because they found very little fluid in the stomach or in the pleural cavities or air-passages; no froth, or but little, in the air-passages; and no special congestion or lividity of the head, neck, and upper chest. They believed that the woman was roughly used and killed before she was put into the water, and that some one probably knelt on her chest.

The finding of the Court was, "Death from cause unknown."

Nothing that transpired at the inquest has changed my opinion as to the cause of death in this case, but I submit it here to your criticism.

APPENDIX.

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A MURDERER'S DYING CONFESSION DISPROVED BY SURGICAL AND ANATOMICAL FACTS.[1]

BY BENJAMIN E. COTTING, M.D., *Associate Member of the Society.*

On the afternoon of July 1, 1874, a woman, twenty-two years of age, of uncertain reputation, was brought to the Boston City Hospital. She was completely paralyzed on the right side, and seemed nearly or wholly unconscious. She had fearful and bloody injuries about the head. The story that came with her was that she had been found in this condition, a few hours before, in her "own hired" room, and in her own bed. When found she was motionless, and was at first supposed to be without life. Her head, neck and shoulders were red with blood; and under them the pillows, sheets and bedding were saturated with it. This blood had flowed freely from a number of open wounds on the left side of the head; but there was no spattering on the walls or objects near by. She was lying on her right side, with her face toward the middle of the room, in the exact position apparently that she had taken on first going to sleep. Her night-gown and the bed-clothing about her body had not been perceptibly disturbed. Her day garments and smaller articles were distributed in an orderly manner about the room, as left by her on going to bed. Except the injuries of the woman, there was no sign discoverable that indicated the presence of any other person during the night. The room door was locked, and the key remained in the lock on the inside. The windows were closed, although one was found unbolted. Through this a person could have entered, or escaped, as the room was on the ground floor; yet a most diligent search failed to reveal even the slightest evidence that anything of the kind had been done. At what hour the woman went to her room no one of the household could tell, and no response had been gained to repeated applications to her door in the course of the forenoon. Although an adjoining room on the same floor had been occupied that night, its inmates declared that they had not heard a groan or a sound from her apartment.

So far as known she had not an enemy; yet doubtless she had angered some one, inasmuch as an unknown man had asked for her the evening before, and, not finding her at home, had vowed terrible vengeance as he left the house.

Who did the deed, and what the instrument used, were mysteries that seemed at the time to be past finding out. To ascertain the former became at once the duty of the officers of justice and the courts; to solve the latter was an appropriate task for medical men.

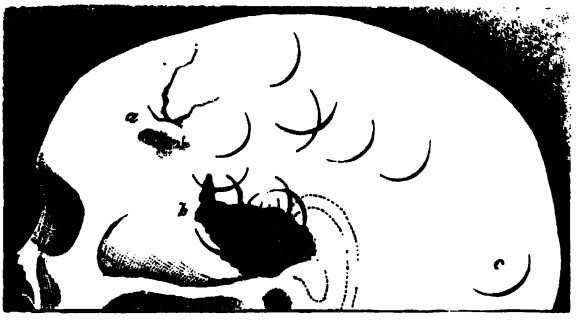
[1] Read before the Massachusetts Medico-Legal Society, June 11, 1889.

On examination at the hospital several extensive and complicated fractures of the skull were discovered, with considerable depressions, thought to be chiefly in the outer tablet and not requiring trepanning. In the scalp were a number of bleeding wounds — the hospital record says "nine on the left side of the head, besides several others near the left ear which cannot be separated." The ear itself was "greatly lacerated," caught as it must have been several times on the edge of the instrument when it passed into the scalp. Its helix also, with the cartilage, was cut through at its anterior upper part. These wounds were all of a curved or crescent shape, clean cut, each "little more than an inch long." From two of them "brain substance protruded in a mangled state"; and into one of them, the only one mangled, the finger could be passed, and carried through the broken skull to a considerable depth, without force, into the injured brain — the record states "fully two inches," and Dr. Cowles markedly (on his finger) confirms this statement. The lines of these wounds turned generally in one direction, inclining towards each other at various small angles; in several instances running together or crossing; some mingling in a confused or inseparable manner — particularly at the spot where the finger could be passed into the brain. The little points or tongues of skin, wherever these wounds crossed each other, were perfect to their very tips, and showed no sign whatever of rent or bruise.

The hair was very long and very thick. "We noticed it," Dr. Cowles writes, "to have been cut off quite sharply in correspondence with the cuts in the skin. . . . I am quite clear as to the cutting of the hair."

From the worst wound (it being indeed where were several of those "which cannot be separated") a few fragments of bone of considerable size were taken; and from just within the external opening of the wound some chopped hair, mixed with the mangled tissues there, required removal. The injuries to the bones, including depressions, were estimated to be within an irregular space of about three inches long and nearly or quite two inches wide, somewhat semicircular at its upper or widest part. The external wounds or cuts, also, with one or two exceptions, particularly one in the occipital region (diagram at *c*) [2]

[2] The following diagram may assist in forming an idea of the number, nature, and situation of the curved wounds in the scalp; and also of the location of the injuries in the skull, at *a*, *b*, and *c*,



as seen afterward in the specimen. Most of the heaviest blows, with the cutting end of the weapon excepting that at *c*, must have been in front of the upper lobe of the ear, towards *b*; that is to say,

were within the limits of such a space. There were no wounds on top of the head, or on any other part of the body.

Now, it is evident that a first blow must have instantly stunned and paralyzed this woman — else there would have been movement of her body or derangement of clothing, of neither of which effects was there any evidence. This blow may have been given by a bludgeon, a mallet or a hammer of suitable size, form and weight. Such blow repeated would naturally extend the fractures, comminute them, and cause any amount of depression in the bony skull. But open wounds in the fleshy scalp by such instruments would naturally have crushed or bruised edges (not the linear cuts here present) and the blows that made such wounds would have caused a spattering of blood all about — not the free bleeding which in this instance blanched the victim and saturated everything near by.

To account for the fractures and depressions, then, did not seem so very difficult — any heavy club might answer. But what produced the curved and curiously situated incisions was a more difficult problem; and experts, professional and lay, called upon to solve it, as well as detectives and friends, all failed to suggest an adequate solution.

Several days after her admission, Dr. Cowles, superintendent of the hospital, called me in, as a consultant, to look at these wounds, to see what I could make of them. The parts had been shaven and fomented. The surface of the skin was quite smooth and uniformly convex — still notably swollen — the swelling covering rather more than the space originally thought to include the injuries to the skull bone. Some of the cuts near the ear gaped a little, but the others were generally in a satisfactory condition, and all had the appearance heretofore described. After hearing the whole story, and having made a careful consideration of the matter in all its bearings, I suggested that such wounds required a sharp instrument (as all admitted), and that the deed had been done by a mechanics' inch-wide *gouge*, — a tool resembling a chisel, but having, instead of a flat, a "hollow" cutting blade, a longitudinal third or trisection of a cylindrical tube. This is bevelled off, like a chisel, to a cutting edge, which in this way becomes curved or crescent-shaped. If the corners also are ground off, as on turners' gouges (*vide* fig. *inf.*)[8] the cutting end partakes of a rounded spear-like form, and presents a drawing edge to whatever may be brought in contact with it. Hence it might cut hair almost as easily as a razor. Its handle is usually of a cylindrical form, and of hard wood. Thus the tool might be just the club for heavy blows, if held by its metallic end, while its cutting edge would most certainly make wounds like those in question.

where the skull was much cut through, where "brain protruded in a mangled state," and where fragments of bone were taken out. The "temple," the part popularly supposed to be especially vulnerable, was evidently aimed at by the assailant.

[8] The figure below represents the cutting end of a turners' gouge, showing its curved shape and the rounded outline of its edge.

Such an instrument had not been thought of; but the suggestion evidently made an impression; for, on the next day, Dr. Cowles came to my house bringing a turners' gouge, of inch-wide blade, a new one procured from a shop, as a specimen by a police-officer, who wished to know whether that was the kind of instrument I had spoken of, as it certainly was. The tool brought to me was twenty or more inches long — its inch-wide steel or cutting portion and its handle being of about equal lengths. Its handle was a heavy billet of hard wood, smooth, cylindrical, slightly ovoid at the end. Such a tool usually weighs about thirty-five ounces, at least a pound more than a policeman's billy. Held by the shank, a blow, given by it as with a club, would be quite capable of crushing in a skull and instantaneously stunning a victim to unconsciousness. Indeed, this would be almost inevitable, and without necessarily breaking the scalp. Repeated blows would have the effect heretofore indicated. This done, the operator, without removing his hand, but by simply turning the tool nearly or quite vertical, with edge downwards, could stab the fleshy parts as rapidly and as many times as he chose, before the victim could have time to revive or even move. He could do this after premeditated intention, or on the impulse of the moment, to thoroughly complete the deed. Such stabs would make clean-cut and curved or crescent-shaped wounds, naturally turned in the direction of those found; and when the instrument was driven with force, it would not be apt to slide or make grooves in the flesh, as a blunt tool would, and might pass directly through the already comminuted bone into the brain itself.

As the skull injuries showed that they could have been made by the handle of a gouge such as that brought to me, so the flesh wounds indicated the blade of a similar instrument. Indeed, Dr. Cowles had already tried the cutting end of the tool he had with him, and found that it would fit the wounds exactly.

Thus the problem seemed to be satisfactorily solved.

Dr. Cowles then went on to say further, that among those interested in the woman was a young mechanic, who was, in fact, so tremulously anxious about her possible recovery as to excite suspicion, and induce the surveillance of the police. Since my visit to the hospital this man had been taken into custody. Proving to be a turner by trade, his workshop and tool-chest had been searched. The chest contained the usual tools, having a series of gouges complete, with the exception of the inch-bladed one. That was missing! The arrested man could not explain its absence, or give any account of what had become of it. He could not even tell when he had used or seen it last; and it was too large a tool to be lost without notice. These were rather damaging circumstances, but he stoutly asserted his entire innocence of the whole affair; and no other evidence was found against him. He had, it appeared, known the woman for some time, and had always seemed to be anxious for her welfare.

The woman, on her recovery of consciousness, did not in any way connect him with the matter, nor at the time even recognize him; in fact, she was never

able to recall the assault or any thing or person of the evening previous — an ante-accident oblivion not uncommon in those who have been severely stunned. The detained man made out an *alibi*, and was subsequently set free. He was generally accounted guiltless of the assault. I am not aware that the missing tool has ever been found, or its loss accounted for.

(As merest conjecture, in solution of this part of the mystery — possibly the man who with "horrid oaths" had threatened vengeance the evening before the assault, while in search of a club, may have robbed the chest of this tool — a very natural thing for a mechanic to do, and not unnatural in any one, on felonious intent. This may have suggested itself more readily to him if he knew the owner was an intimate of the threatened woman, as in such case the missing tool would tend to divert attention from himself and to turn it upon another man. Besides, the carrying a tool would not attract notice; whereas the possession of a club might arouse suspicion. The deed done, he could easily throw the tool into the waters of the dock near by, nevermore to be seen of men. There was, moreover, as rumor had it, an unaccounted for disappearance from the neighborhood of a man quite competent to all this.)

The injured woman, after a protracted convalescence (during which the paralysis gradually disappeared) and a residence for a time at an asylum, at length regained her usual health and sanity. Before she was discharged, however, she declared her fixed determination to return to her old mode of life, and was soon lost sight of except by the local police of her own immediate neighborhood.[4]

In May, 1876, nearly two years afterward, a condemned murderer, a few days before his execution, made a "confession" of many of his misdeeds, and claimed this assault as one of the number. He stated that by chance that evening he had met upon the street this woman, before unknown to him; that he went with her to a restaurant; thence to her house, and passed the night there; that, in the early morning, while she was yet sleeping, he pounded her on the head with a hammer and then left her for dead. He further stated that the hammer might be found buried in the earth in a cellar he had access to at that time. He had had other things there, for murderous purposes, awaiting opportunity. The finding of a hammer gave credence to the story, which was pretty generally acquiesced in. But having had much to do with the case for which this man was to suffer (his last victim having been my patient), I distrusted the narration. Yet what motive, it may be asked, as it has been, could impel a man so situated to make misstatements? Although now concerned with facts, not motives, here is one among others quite conceivable. At about that time, in another case, a death sentence was delayed and a commutation expected (afterward actually granted) on the open avowal of murders and other revolting crimes, on the ground that "irresistible impulse," or some-

[4] Dr. Edward Cowles, now Superintendent of the McLean Asylum for the Insane, at Somerville, Mass., kindly permits me to say, that to the best of his knowledge and belief the case in my paper, so far as it came under his observation and cognizance, has been related by me in a true and faithful manner.

thing of the kind, had rendered the villain ***not responsible.*** More than one murder was chargeable to the convict now awaiting execution. A long list might save his ***life***, if his philanthropic symphathizers (after having denounced his sentence as unmerited and too hasty) could be induced to urge upon the government the plea that "he couldn't help it." It would have been the venture of desperation; but it was too late.[5] He soon became "much mixed," and finally broke down.

As to my patient, I had, as her murderer at last acknowledged, given in open court more correct details of the deed than he was able to recount when, in sight of the gallows, he attempted a narrative of his now admitted crime, — admitted to his amazed legal defender, whom he had deceived, up to that moment, into full belief of his innocence.

In regard to the injured woman, his statements were so defective, or so at variance with my observations as a medical man, that, for myself, I soon became convinced that he never had had anything whatever to do with her, unknown to him, as he admitted, up to the day of the assault.

But the hammer! It was (I have seen it) a smiths' hand or riveting hammer,[6] with circular face of seven-eighths of an inch in diameter, not very sharply defined at the edge, but enlarging almost at once into a square form of an inch and three-eighths diagonal line; weighing only a little more than a pound, handle and all. It is not very likely that a first blow with this instrument would completely stun in an instant, and thoroughly paralyze one struck by it, or would cause, with its small face, large fractures or depressions in the skull, or any fracture at all without leaving small, limited, pulpy bruises in the scalp where struck, instead of a large, uniformly smooth swelling, as in this case. The ***pein***, or wedge-shaped end of such a hammer, if the blow were of sufficient force, might cause a fracture, but then the wound left in the scalp would be a ***straight***, mangled furrow or indentation. In like manner its round face would leave a soft or pulpy and somewhat cup-shaped depression. If an open wound of the full size of its face could be so made, it would be circular, of course; but if less complete and of an inch in length (more than the diameter of this hammer's face), it could not be of a lesser arc than a semicircle. One or two such wounds, segregate, might be ***imagined***, perhaps, but half a score or so would be clearly impossible. Now, the wounds we had to deal with were crescent-shaped, not semicircular; were sharply defined incisions, all of equal lengths, variously inclined and running into or crossing each other, and in themselves hardly conceivable as the work of a hammer, or as made by anything else than a sharp, cutting instrument. Besides, no hammer's blunt face could be forced into and through the skin, except at an angle, and then the opening would be bruised down on one side and crushed off on the other,

[5] This supposition is not necessary to the argument, and perhaps it implies too great facility in expedients; but a man who could thoroughly hoodwink his friends and advocates at will, could readily take a new tack when convinced that the one he was on was soon to prove fatal.

[6] A friend reminds me that the murderer said that he used a plasterers' (that is, lathers') hammer — quite a different tool from that found; an instance of his inability to give details correctly. The hammer, as found, was so defective and weak in its handle, where attached to the metallic head, that a very feeble blow would have broken its head off. It was exhibited to the Society, as were also other hammers, a gouge of the size named above, and the anatomical specimen.

according as the instrument slipped, as it inevitably would more or less, on a rounded skull. Furthermore, we repeat, wounds made by a blunt tool might spatter their blood, but not set running so many freely flowing vessels. Bruised wounds do not bleed like incised ones. Again, and fatal it would seem in themselves to the "confession," —

(*a*) No hammer, however keen its circular face-edge, or other blunt tool, could make such "sharp" ***cuts*** in and through the mass of hair this woman had, — no, not one such; much less a score; (*b*) Nor is it possible, supposing a human arm had the power, that a hammer-head, being only one inch and seven-eighths in length from its face to the hole for its handle, could be forced through such hair, scalp, and skull, into the brain to a depth in all of "fully two inches," without making a much larger opening, carrying in to the very depths hair, flesh, and fragments of bone, and leaving a very different state of things on the outside from that here found.

Not long ago, March 20, 1889, fourteen years after the injured woman left the hospital, a notice appeared in the newspapers that her body had been received at the morgue. I immediately called on Dr. Harris, medical examiner, who at once, with most courteous readiness, offered all facilities for investigation possible at so late a period. He had not known anything of her previous history; but had been told that after a prolonged drunken debauch, of which she had had many, nature giving way, she fell into a state of exhaustion, and in a few days thereafter had a painless and peaceful death. The cause of death had been officially reported, "alcoholism."

Even in the grimness of her then grewsome surroundings, and after such a life, she was not ill-looking. Her face and features were not disfigured. She had "never had disease," except from alcohol, and was not wasted. Her hair was quite extraordinary in abundance, great length, softness and glossy blackness. It had been well cared for; even the officials of penal institutions had respected it; and, contrary to their usual custom, had left her in full possession.

There had been an autopsy, and everything had been replaced. I sought out, however, the external scars in the scalp — an important matter. They were not easy to find at first, on account of the thickness of the hair. They were there, nevertheless; and except near the ear, where there was a wrinkled group, they were delicate, linear, crescent-shaped scars, unmistakably the result of clean cuts or incisions healed by first intention. They were not the scars of bruises. There could be no doubt in the matter.

Some weeks later I had a chance to see the skull. Looking at it in front, a general depression of the middle of the left side, as compared with the right, was quite evident; and this occupied about the space estimated in the first examinations at the hospital. Such a uniform and shallow depression suggested the result of blows by a weapon of considerable size, without angular projections.

On side view, about two inches above the anterior third of the zygomatic

arch, there appeared evidences of former fractures (diagram, at *a*). From a point on the frontal bone near the parietal, several lines of old callus radiated at acute angles, as from a centre. Between two of the uppermost of these was a double triangular prominence about an inch long and quite an inch and a half or more wide, diminishing in width towards the base.

Very likely the fractures at this place came from the first blow the woman received from her assailant.

On, or just above the level of the zygomatic arch, there was an oblong opening in the skull — beginning at the largest portion, just in front of the anterior part of the temporal ridge, and extending forwards about two inches (diagram, at *b*). The upper and lower bony edges of this opening, irregular in outline, were not rough, having been smoothed off naturally in progress of time since the injury. The lower border seemed to be of two nearly equal lines, each very slightly curved, joined together at an angle opening upwards, of about a hundred and twenty degrees. The upper border of the opening was rather more irregular, but equally smooth. The anterior limits ended in a point almost, while the posterior or aural portion was three-fourths of an inch, or more perhaps, across. From this space undoubtedly, came the fragments of bone removed at the first examinations. Here too, near the ear, the finger could have been passed into the brain.

On the occipital bone, about three inches behind the meatus auditorius, there was (at *c*) a well-marked curvilinear depression of about an inch chord, which, with a slight ridge inside, gave strongest evidence of a former wound by an instrument that had gone completely through the skull at this point. This was where (in Dr. Cowles's trials, before mentioned) the gouge would most exactly fit the fleshy wound; and the prolonged depression of the enclosed fragment of skull showed with what difficulty the tool must have been wrenched from its impackment in the bone. Now, indeed, if any one can conceive of anything better adapted to produce such a wound than a gouge, he must have greater powers of imagination than I can lay claim to. Even with such an instrument, the blow must have been given with very great force. Not to insist that, in the position the victim was lying, the blow of a hammer in the hand of an assailant, if it made a curved indentation, must have made one in a different direction, — no hammer-head, even if held as a punch and struck by a sledge, could be driven through all the coverings of the skull, and the skull itself at that place, and simply cut out, or force in, a circular, or as in this case an almost semicircular, fragment. A general crush of all the neighboring parts would be inevitable.

There did not appear to be anything else in the "specimen" attributable to the assault now under discussion.[7]

To recapitulate, — it appears, from the length and width of the space involved

[7] There were three little depressions in the outer table near the vertex, two on one side and one on the other of the sagittal suture. They were each capable of holding half a large pea, flattened. They were out of the reach of a weapon of any kind as the woman was then lying; and, as there were no wounds of any kind in that region when she was admitted to the hospital, they could not have had anything whatever to do with this assault. I have the support of the highest authority in saying that there is nothing in the "specimen" inconsistent with the theory that a gouge was the instrument used by the assailant.

in the fractures, and from the fact that the depressions were in the outer table chiefly, that the victim had been struck by a club of some kind, — one of considerable size, and smooth also, inasmuch as the scalp was not laid open by it;

That, instantly stunned and paralyzed, her motionless insensibility permitted other blows, and the infliction of any number of open wounds;

That the wounds actually made, a score or so scattered or inseparable, were curved or crescent-shaped, with clean-cut edges, the little points, at the crossing of any two being whole and clearly defined, not bruised; that these wounds were of nearly equal size, each a full inch in length; and, further, that they were cut through thick hair "quite sharply," and through the scalp also, in one or two instances going quite through, and deeply into the brain; all evidently done by some kind of sharp-edged instrument;

That these wounds bled freely, as cut wounds generally do;

That a turners' gouge fulfils all the requirements of the case, whereas the hammer utterly fails in regard to the open wounds. and, as I think, in every particular.

Such are the premises; and such the offered solution. An adequate explanation, however, ought to be enough to hold against the improbable or the defective.

To some persons the circumstances attending the so-called "confession" may seem to add credibility to the murderer's story, but they should not. The confessions of criminals, even when without motive and only tending to increase their infamy, are not received by courts of justice unless supported by other and more trustworthy evidence. Dying persons, in their feeble and imperfect utterances, seldom fully know what they are talking about, as momentary revivals often prove. In the partial delirium of weakness, as in half-sleep, a person striving to say one thing, may utter something very different from what he wishes, semi-consciously, and in spite of himself. Last words, ordinarily of little moment, should be construed with caution, for too seldom, in fact, can they bear the interpretations one would gladly give to them. Death-bringing illness, while killing the body, generally, even where and when least expected, nearly obscures or clouds the intellect, and fills the mind with baseless delusions. The dread of the dungeon has induced a philosopher to renounce his discoveries; the fear of the rack has caused a reformer to retract the truths he had proclaimed; so, too, the crushing terrors of impending destruction seem at times to start up in a culprit's mind remembrances of crimes which he never committed.[8] What wonder then, that, broken down by despair, the last straw of hope floating away, with mental powers utterly demoralized,[9] a doomed man, with or without rational motive, should magnify his many misdeeds, assuming the acts of others, and incorporating them with his own.

[8] "An instance of remembering events that never occurred." — H. W. B., on testimony in another noted case.

[9] A recipient of another part of the "confession" says of it that it was "true so far as a person with a mind so thoroughly demoralized as his had been, could make it." In fact, it is to be surmised that his statements generally would require corroborations from other testimony.

At all events, this portion of the murderer's "confession" I did not believe at the time. I do not believe it now. Facts in the case disprove it.

N. B. — After reading my paper, a friend called my attention to an article in the London *Lancet* (April 20, 1889, p. 819) wherein the writer asks, "Are most dying declarations unreliable evidence, and how may we differentiate them?" and then says, in answer, "If a human being be aboulic, . . . if suffering from extreme nervous exhaustion through terror or otherwise, . . . his [dying] statements are unreliable as evidence, . . . and the sooner medical jurists insist on the alteration of the position and value of such testimonies the better it will be for society and for mankind."

ON METHODS OF EXAMINATION IN MEDICO-LEGAL CASES INVOLVING SUITS FOR DAMAGES FOR REAL OR SUPPOSED INJURIES TO THE BRAIN AND SPINAL CORD.[1]

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WHEN a patient has been for a long time the victim of nervous disease, it often happens that he is disposed to exaggerate his symptoms, or else he may be, from his natural incapacity or as the result of disease, incapable of giving trustworthy information. These sources of error are also present, sometimes even to a greater degree, in patients with nervous disease due to injury. In such cases the victim of an accident returns to consciousness to meet the letter of the "shyster" lawyer, who urges him to bring suit against the persons or the company liable for his injuries; he has the question of a law suit presented to him in repeated family conclaves; he is visited by experts who subject him to all sorts of examinations; he is exposed to the worry and excitement of a trial, with its appeals and delays; through it all he is harassed by the vital questions, "What will become of me? Shall I be able to earn any more money? Who will provide for my wife and children?" At last all is over, he is left to himself, his anxieties about money are relieved, and, being free from excitement, he not unnaturally gets better. In the majority of cases the symptoms are largely subjective, and the railway surgeons, unused to the symptoms of nervous disease and incapable of estimating them at their true value, note the improvement and say that the man was a fraud. In many cases, however, the improvement is partial and often only temporary. Besides there are, perhaps, other cases where the patient has sustained some trifling injury; these cases are undoubtedly not seriously injured, and some of them are undoubted frauds, and are successful in imposing upon the railway companies. It behooves us, therefore, to study carefully the symptoms, and to see in what ways we can determine whether the case before us is genuine or not. It is my purpose, therefore, in this paper to speak of some of the methods which the physician should employ in his examination. In so doing I shall avoid saying much of methods which require special and complicated apparatus, and I shall speak only of those methods of examining special organs like the eye or the ear, which the general practitioner ought to understand and to be able to employ.

In the first place I would say here, once for all, that in examining the pa-

[1] Read before the Massachusetts Medico-Legal Society, October 2, 1889.

tient, he should be carefully and unobtrusively watched during the whole period of examination. In this way many efforts at simulation may be detected, a paralyzed limb will be seen to be moved, an assumed expression will be dropped, or a feigned lameness will disappear. This obvious injunction is, however, so familiar, and has been so repeatedly insisted upon, that it has led to a source of error. When certain symptoms are elicited only by special methods of research and do not appear during the patient's ordinary acts, it is often hastily and incorrectly assumed that they are simulated. Now it is perfectly well known that we have precisely such a state of affairs in many organic diseases of the nervous system. In the early stages of tabes dorsalis we may note no peculiarity of the patient's gait or station, but if we make him walk or stand barefooted and with his eyes shut we can detect the beginning of ataxia. In multiple sclerosis the characteristic intention tremor may be absent when the patient performs the more automatic movements of taking off his hat or shaking hands, but when he tries to write or lift a glass full of water to his mouth the tremor appears. It is obvious, then, that if we reject such tests, we deprive ourselves of extremely valuable data for diagnosis. Moreover, if we consider the mental processes which the simulator would naturally employ, it is not credible that he would conceal his symptoms from ordinary view and reveal them only on the application of unfamiliar and highly specialized tests. Feigned symptoms are aggressively prominent, but in many of these cases there are many symptoms which must be searched for with care and inquired after in detail. Such symptoms, although subjective, that is dependent upon what the patient tells us or does himself, are in my opinion, of great value, and afford evidence second only to the purely objective phenomena. Of course, I do not include answers to leading questions, as in regard to pain or peculiar sensations, but rather the results of examination into disturbances of motion and sensibility. Furthermore, symptoms of a slight and partial character, such as slight loss of sensation, poor vision, slight tenderness, etc., are more apt to be genuine, for the simulator usually goes to extremes.

In what I have to say I shall touch lightly upon the symptoms of the typical organic affections which may follow injury, such as transverse myelitis, paralysis from direct injury to the brain or cord, fractures, neuritis, or the typical degenerative diseases like tabes or general paralysis. Such results of injury are less common, and the symptoms of these affections are usually so well marked that the diagnosis is easy. The chief difficulty lies with the cases of so-called "spinal concussion" or "railway spine," the "traumatic neuroses" of the recent German observers.

In the first place, then, a full history of the patient's trouble should be taken, including an account of the accident. This history should be taken without the presence of a third person, unless another physician be present. Careful inquiry should be made in regard to all the symptoms, and the functions of all portions of the body should be investigated. After that it is well to get a supplementary account of the patient's condition from some member of the

family. Statements from casual acquaintances who see and can know little about the patient are not of much value. During this time many of the symptoms to be spoken of later should be noted and the estimate made as to the mental condition.

PSYCHICAL SYMPTOMS.

It is comparatively rare that we meet with any pronounced type of insanity following injury. There is a form of primary traumatic insanity with dementia, disturbed consciousness, confusion, hallucinations and maniacal outbursts which is occasionally observed. Dementia and general paralysis may also rarely follow injury. For the detection of these I must refer to the treatises on insanity, noting in passing, that many alienists think that simulation of insanity is in itself a symptom of mental derangement.

In the majority of cases, however, there are distinct psychical disturbances, not reaching the degree of actual insanity, which can be detected on careful examination. The patient has an anxious, furtive, restless look, or else he may be distinctly melancholy. He is sometimes distinctly emotional, and bursts into tears on slight provocation, shedding actual tears. He becomes distinctly hypochondriacal. He wanders about restlessly with his fingers fumbling with his clothes, or twisting together. More often he sits by himself, avoiding other people, caring little for what is going on, and taking little interest in anything — even in his suit for damages. He has little to say, and what he says is in a constrained tone and broken by sighs or gaspings for breath. The memory and the mental power are much poorer than before his injury. He is, moreover, abnormally irritable, and he shows it by objecting to examination; he cannot bear the noise of his children or the slightest disturbance of his domestic life. Finally, the power of persistent mental or physical application is lost; although he may attempt to work he cannot pay attention to it nor keep at it; and when at home, he never can occupy himself in anything. Reading or listening to reading becomes impossible after a few minutes. The whole train of psychical symptoms may also have brief periods of exacerbation, "anxious spells," lasting a few moments and being attended with increased frequency of the pulse.

This psychical symptom-complex, with its marked features of irritability, depression and loss of power of persistent application, is of very great value in diagnosis. It is present to a greater or less degree in the majority of severe cases. I believe, moreover, that it is practically impossible to feign this condition successfully. If the patient himself produces upon the physician, after careful observation, the impression of this condition, and if his own statements and the statements of his family corroborate it after close questioning, it may be set down as genuine. It may require several observations, but, if the physician be sufficiently familiar with mental disturbances to be capable of judging intelligently concerning them, a definite conclusion can be reached, and the patients possessing medical knowledge and the immense dramatic skill requisite to simulate this condition successfully are very few.

In addition to these psychical symptoms the patient will often report certain other cerebral symptoms, which should be given some weight. Headache is common, but usually it is said not to be very severe — the simulator's pains are generally intense. Vertigo is often present. The speech is seldom much disturbed, except in the way I have just mentioned. Hoarseness demands a laryngeal examination to discover its cause. True aphasic symptoms are absent except in cases of direct injury to the speech centres. The characteristic speech of general paralysis and multiple sclerosis is familiar. In these affections, too, the handwriting is typical, and a specimen of it ought always to be procured.

Before speaking in detail of the physical examination it may be stated that a careful examination of the body should be made for evidence of local injury, bruises, wounds, scars, or fractures.

MOTOR SYMPTOMS.

Eye. — Each eye should be examined separately, and then both together. We must note the power of movement of the eye-ball in all directions, the size of the pupils and their relation to each other, and the reaction of the pupils to light, accommodation, and irritation of the skin of the neck. Although it is sometimes a problem of exceeding difficulty to determine just what muscle or muscles may be paralyzed, it is usually an easy matter to determine that some muscle is paralyzed, and the simulation of paralysis of any muscle of the eye or of the eyelid is impossible. Nystagmus is another incontestable symptom, but it is often to be noticed only when the eyes are turned in one particular direction. This symptom is occasionally present in traumatic neuroses, but oculo-motor paralysis is extremely rare. In oculo-motor paralysis the patient will complain of double vision. It occasionally happens that the patient has double vision with only one eye. This is so rare a symptom and apparently so impossible that no simulator would venture to feign it. Therefore, when it is reported, the chances are greatly in favor of its genuineness.

Dilatation or contraction of the pupils may be produced by drugs; in that case they will not respond to light or accommodation, but in dilatation from disease the same thing may happen. Unequal pupils that react are incontestable. They are not common, however, except in degenerative diseases like general paralysis. Temporary inequality from an abnormally mobile pupil is occasionally seen in neurasthenic conditions, and has little significance. In pupils of moderate size a failure to react is also incontestable evidence of disease, and the proof is even stronger if the pupils react to accommodation and not to light. This is occasionally noted in traumatic neuroses, and is not uncommon in tabes and general paralysis.

Most of the oculo-motor symptoms, therefore, are of a class that are purely objective and cannot be feigned, but in the majority of cases of traumatic neuroses they are absent. In obscure cases, therefore, their absence can count for little, but their presence means very much.

Face. — Paralysis of all branches of the facial nerve cannot be simulated, but it is due to peripheral trouble and is very rarely seen after injury. Paralysis of the lower part of the face is seen in certain forms of brain disease, and is not easy to simulate. In central paralysis the power of voluntary movement may be lost, and yet the face may move from emotion, as in laughing or crying. If such a thing is noted it therefore does not prove simulation, but rather the reverse, for, if a simulator had so great skill as to feign facial paralysis successfully, he would be very likely to manifest it constantly. Fibrillary tremor of the face and tongue is of considerable value in the diagnosis of degenerative diseases like general paralysis, and is, of course, incontestable. Paralysis of the tongue is so rarely seen in any traumatic case that it need not detain us.

Paralysis. — It is well to examine the limbs systematically, beginning with the arms, and directing the patient to make all the movements at each joint, proceeding from the trunk to the periphery. All the joints should also be moved passively to detect any joint disease. Then the patient should be directed to make the principal movements against the resistance of the examiner, which affords the only practicable test of muscular strength, although it is not a test which can be expressed in figures. I need not call attention to the fact that the distribution of the paralysis is a guide for the localization of the disease. Paralysis is a favorite symptom for the simulator, and the detection of a bogus paralysis is not always easy. Fortunately our suspicions need not be excited unless we meet with a paralysis without anæsthesia, contracture, altered reflexes, atrophy or electrical changes. In such cases much care is needed to detect fraud. The unexpected application of a very strong faradic current or the ostentatious use of the actual cautery, may cause a movement of an alleged paralyzed limb. When a patient with a paralyzed arm stoops the arm drops to the perpendicular; the simulator is apt to keep his at his side. Actual paralysis, however, is rare. It is seen, of course, in transverse myelitis, where the other symptoms render the diagnosis easy, and in neuritis, which, as I have shown elsewhere,[2] is not an uncommon complication of "concussion" cases. It is also observed in the hysterical monoplegia so graphically described by Charcot — the "local traumatic neurosis" of Strümpell[3] — which, like all forms of traumatic hysteria, is very rare in this country. In the general traumatic neurosis there is rarely any paralysis, but all movements are slow and feeble, and the contraction of any group of muscles cannot be maintained, as some forms of dynamometer will show. Here Oppenheim[4] has shown that the suspicion of simulation may be wrongly excited because the patient apparently calls many muscles into play, makes a tremendous effort, and accomplishes little, as if he were really holding his muscles in restraint. This is not due to simulation, however, but to the loss of memory of the motor force necessary. Weakness is more likely to be genuine than actual paralysis, and, when combined with other symptoms is of considerable value.

[2] Boston Med. and Surg. Jour., November 1, 8, 1888.
[3] Berliner Klinik, 1888, Heft 3.
[4] Die traumatischen Neurosen, p. 107. Berlin, 1889.

Gait. — Beside noticing the ordinary gait we should make the patient walk with his eyes shut, making quick turns, and also walk barefooted, which will reveal slighter changes. The ataxic and cerebellar gaits are occasionally seen, but the commonest gait in the traumatic neuroses is an approximation to the spastic gait, with short, shuffling steps. There is no absolute criterion of the genuineness of the gait. Above all in the majority of cases all movements, especially sitting and rising, are governed by the necessity of keeping the spine rigid. Of this stiffness in the back I will speak later.

Contracture and Spasm. — Contracture can be readily distinguished from active efforts to hold the limb in the same position, by the absence of any visible and active contraction of the muscles. It is impossible to feign this condition, but it is rare except in gross disease of the nervous system and in hysteria. In the traumatic neuroses, however, there is apt to be more or less rigidity of the muscles, which is readily recognized and not very apt to be simulated. Clonic spasm is seldom if ever seen.

Convulsions. — Temporary lapses from consciousness are occasionally reported, often associated with vertigo, but true convulsions are rare except as a result of injury to the head. If there is a history of convulsions corroborative evidence may be afforded by bodily injuries or scars on the tongue. If the patient be seen in a convulsion the presence of dilated and immobile pupils is the best test for its genuineness.

Tremor. — Not only must we note the existence of tremor when the patient is presumably off his guard, but we must observe whether it is present during the performance of certain rather delicate movements, such as lifting a glass full of water to the mouth. The latter, for reasons already given, is more apt to be genuine. In traumatic neuroses, a general tremor is not uncommon, and sometimes it extends to so many muscles, including the muscles of the neck, that simulation is hardly possible. The true intention tremor, such as is seen in multiple sclerosis, is occasionally seen in these cases, and is a symptom not likely to be feigned, or if feigned, it will be introduced into the more automatic movements and suspicion may thus be excited. Intention tremor when genuine is a symptom of considerable value as indicating organic disease. Fibrillary tremor, seen most commonly in the limbs in muscular atrophy, is an incontestable symptom.

Ataxia. — We must test the accuracy of movements with the eyes open and shut, and compare it with the accuracy of unconscious movements. We must test the patient's power of standing, of standing with the eyes shut and the feet together, of standing on one foot and of standing barefooted. Swaying when barefooted with the eyes shut and not with the boots on is again a valuable test of genuineness. The patient's power of keeping the limbs in a fixed position with the eyes open and shut must also be tested. There is no absolute criterion for any of these forms of ataxia, but the presence of the more delicate shades of it is of much value. Ataxia is occasionally seen in traumatic neuroses, but it is not very common. Its significance in tabes and neuritis is well-known.

Muscular Atrophy and Electrical Excitability. — Much stress is laid upon the electrical reactions in the courts, and a recent writer goes so far as to say: "injury to the spinal cord should always be indicated by muscular atrophy in a more or less marked degree, and when no change is noted in the nutrition of the muscles, doubt may well exist in the mind of the expert as to there having been any concussion of the spinal cord."[5] If by "concussion of the spinal cord" is meant the condition once called by that name and now generally recognized to be cerebral as much if not more than spinal — the condition in short, to which I have repeatedly referred in this paper as the traumatic neurosis — I would say that muscular atrophy is rarely present, even in fatal cases, and that the electrical reactions in the majority of cases reveal nothing. Nevertheless, the electrical reactions should always be tested, for, when they are altered, we have incontestable evidence of organic disease of the highest value. In some cases there is a complicating neuritis, with its accompanying electrical changes. Apart from this, muscular atrophy in the traumatic neuroses is rare, and although quantitative changes in the electrical reactions are sometimes seen, the qualitative changes of the degenerative reactions are as rare as atrophy. In testing the reactions the indifferent electrode, which must be "large," (5 x 10 cm.) well covered with absorbent cotton, and thoroughly wet, should be placed either on the sternum or the mid-dorsal region, but, whichever position be selected, the same position should be chosen in all cases. The nerves and muscles should be tested, at the appropriate motor points, with a "normal" electrode (10 sq. cm.) on an interrupting handle. The faradic current should be used first and the position of the cylinder noted for the earliest reaction. The galvanic current should then be used, with a galvanometer in circuit, and the smallest current (in milliampères) noted at which KaSZ and AnSZ occur. Beside this we must note whether contractions be slow or quick. If muscular atrophy be apparent on inspection, careful measurements should be taken, and the presence of fibrillary contractions noted. Of course, the emaciation not uncommon in these cases of protracted illness would never be mistaken for true muscular atrophy. Although the one-sided view of refusing to recognize cases as genuine unless muscular atrophy be present, is utterly incorrect and misleading, still, as I have just said, in the very rare cases where it is present it affords absolute and incontestable evidence of disease, especially where electrical changes are added.

I may say, in passing, that general emaciation, to which I have just referred, is, of course, evidence in favor of a chronic disease and it is not a thing to be simulated.

REFLEXES.

Cutaneous Reflexes. — The important skin reflexes to be tested are the plantar, cremaster, abdominal and epigastric. The last two are occasionally absent in health, but absence of the first two is always significant. An-

[5] H. H. Smith, Jour. Am. Med. Assoc., August 10, 1889.

other symptom of importance is a difference between the reflexes on the two sides of the body, which is always indicative of some nervous disorder. In many cases these reflexes are undisturbed, but when there is disturbance it is a symptom of disorder in the nervous system which cannot be simulated. This disorder is not necessarily coarse organic disease, for in hysterical anæsthesia the skin reflex may be lost, but the changes in the reflexes signify some genuine trouble.

Tendon Reflexes. — The most important reflex here is the knee-jerk. The best way to obtain this is to seat the patient on a table with his legs hanging over the edge. The legs should be bare, and all constriction removed. By placing one hand upon the quadriceps any attempt at voluntary control of the muscle can at once be detected. The muscle should be relaxed, and the tendon struck with a percussion hammer, a book or the ulnar edge of the hand. If there is no response the patient should re-enforce the reflex by clenching the hands tightly. Persistent absence of the knee-jerk under re-enforcement I believe always signifies organic nervous disease. If cases do occur when it is absent in health they are extremely rare and still questionable. Absence of the knee-jerk, almost constant in tabes and multiple neuritis is extremely rare in traumatic neuroses. In the majority of cases it is somewhat exaggerated. If the jerk is very lively the leg should be extended, the finger placed over the patella which should be drawn down and the finger should be struck a smart blow with a percussion hammer. When the knee-jerk is exaggerated this will cause a contraction of the muscle, and in extreme cases it will set up a clonus. It is a rather delicate and an incontestable proof of exaggeration. Gower's front-tap contraction is another delicate test. Neither of these, however, indicate a degree of exaggeration that is necessarily abnormal.

When the exaggeration is abnormal sudden dorsal extension of the foot on the leg while keeping it strongly extended will give rise to a clonus. If this or the patellar clonus or both be present on repeated examination we have incontestable proof of organic nervous disease. Ankle clonus, however, is of value only when there is a persistent rhythmical clonus. A few irregular contractions soon dying out mean nothing. This clonus when persistent and constant is indicative of disease in the lateral columns of the spinal cord. It is rare, however, to find it in traumatic neuroses.

In a few cases, especially in hemiplegia and paralysis of one arm, the reflexes from the upper extremity may be of interest, but, as a rule, they have much less value.

SENSORY SYMPTOMS.

Anæsthesia. — The best method of testing the sense of touch is by the finger tips. By a little contrivance the hand may be held so as to hide the finger, and the patient, even when not blindfolded, cannot see whether he is touched; moreover, the physician can thus regulate the strength of the touch perfectly. The compass æsthesiometer is of very little value.

In the majority of cases of traumatic neuroses the sense of touch is diminished in some part of the body, and it may even be absent. Exact hemianæsthesia, however, is rare. For simple diminution of sensation we have no criterion other than careful testing, but where absolute loss of sensation is feigned the strongest faradic current through a wire point or the actual cautery will usually prove too powerful to be borne. If the anæsthesia have a sharply defined boundary it is genuine, for my own experiments coincide with Dr. Putnam's in showing that it is impossible for a simulator to maintain such a boundary with exactness. The reverse of this does not hold, for the limit of anæsthesia in genuine cases may vary from day to day. The distribution of anæsthesia has also some value in localization.

The sense of locality is tested by making the patient indicate, with his finger, his eyes being closed, the part touched. The sensibility to pain can easily be tested by pricking with a pin. The sensibility to temperature can be tested by breathing and blowing upon the skin, or by applying teaspoons or test-tubes to the skin, heated or cooled. The sense of pressure can be readily tested by the pressure from the finger tips. All these forms of sensibility should be tested, for they may be affected even when the tactile sensibility is normal. Tabes, of course, presents the greatest number of anomalous forms of sensibility. The senses of pain and temperature are lost in syringo-myelia. I saw a case of traumatic neurosis not long ago, where all other forms of sensibility were normal, but the sensibility to pain was lost over one-half the body. In such cases the question of simulation is in the highest degree improbable.

Delay in the conduction of sensation should also be noted, by making the patient speak as soon as a touch is felt. This is a symptom seen occasionally in tabes, but rare elsewhere. It is not likely to be simulated, but we have no criterion of its genuineness. If the compasses are used we may sometimes meet with polyæsthesia, but I have never seen it except in tabes.

The muscular sense should be tested in two ways. The patient, being blindfolded, should be told to put one limb in the same position as the other, which has previously been put in some unusual position by the physician. This tests the sense of position. Then the limb should be moved passively, taking hold of it in a plane at right angles to the plane of motion, so as to avoid pressure, and the patient asked about the movement. This tests the sense of motion. We have again no criterion of these tests, but they are distinctly beyond the ken of the average simulator, and hence they have considerable value. Muscular sense may be impaired with the other forms of sensibility in the traumatic neuroses, but the disturbance is less common.

Hyperæsthesia. — For hyperæsthesia in the strict sense of the term, we have no practical test, but what we usually call hyperæsthesia is really hyperalgesia, that is, an increased susceptibility to pain. It occasionally happens that we meet with extreme tenderness of the skin to a slight touch. when deep pressure is comparatively painless. This is by no means a proof of simulation, but it is more common in hysterical affections than in or-

ganic disease. The existence of hyperæsthesia is manifested during the test for anæsthesia. At a recent meeting of the neurologists and alienists of South-west Germany, at Baden-Baden, Rumpf reports an expedient recommended by Mannkopf.[6] It is to note the pulse during pressure on an alleged painful spot. If the pressure really causes pain, the pulse will be quickened. This, however, although valuable in cases of marked tenderness I have found does not hold for moderate degrees of tenderness such as we find in many cases of neuritis. The diagnostic value of tender points in neuralgia is considerable, and few would be likely to know enough to simulate them.

Pain. — It may be well to speak of pain, although it is purely a subjective symptom. As a rule the pain of traumatic neuroses is not very severe, but sometimes it may be. Occasionally neuralgia, due very often to direct injury of a nerve, may complicate the symptoms. The lancinating pains so common in tabes, are very rare. In genuine cases, it often happens that the pain leaves little impress on the countenance, so that we cannot take it as a guide.

Paræsthesia. — In a good many cases the patient will complain of various forms of paræsthesia, but, of course, we have no criterion of their genuineness. Two forms only need be spoken of as suggestive. One is paræsthesia in the ulnar region, which is suggestive of tabes; the other is paræsthesia in the form of a girdle, which is met with only in organic disease of the cord. The value of this symptom is increased if we get a history of its moving up the body.

Pain in the Back. — I have already referred to the efforts which many patients have to keep the back rigid. Pain in the back probably occurs only when there has been direct injury in that region. It is most commonly due to a traumatic lumbago, when the pain is increased on motion and the muscles are tender on pressure. In a few cases there is a pure neuralgia, ilio-inguinal or lumbo-abdominal, where the pain is more severe but less influenced by motion, and the tenderness is chiefly over Valleix's points. In cases of pure traumatic neurasthenia the pain is not affected by motion, and there is great tenderness over the spinous processes — the "spinal irritation" of former days. For a fuller discussion of this subject, I must refer to the recent paper of Dr. J. A. Jeffries, read before the Massachusetts Medical Society. The determination of the variety of pain is usually easy, but we can judge only approximately of its genuineness. Pain in the back is never the sole trouble, however, but it is a frequent complication in the traumatic neuroses.

SPECIAL SENSES.

Smell. — To test the sense of smell we must employ familiar odors, camphor, peppermint, etc., carefully avoiding irritants like ammonia. If the smell be lost the nasal mucous membrane should be examined. Loss of smell is a purely subjective symptom, and one of little value except when unilateral, when it may be of corroborative evidence in hemianæsthesia.

Sight. — The vision should be tested for each eye separately, with the ordi-

[6] Centralblatt f. Nervenheilk., No. 12, June 15, 1889.

nary test-types. If the vision be diminished, with no ophthalmoscopic changes, a careful test of the refraction is necessary, which requires the training of a specialist. In many cases of traumatic neurosis, the symptoms of asthenopia are manifest, blurring, spots before the eyes, photophobia, and a rapid failure of vision after looking at an object for a few moments. I must refer to special treatises for the tests for feigned blindness.

The color sense is usually unaffected, but it may be impaired in one eye in cases of hemianæsthesia, and it is well to test it with worsteds, according to the usual rules. In one or two cases it has been reported that everything looked yellow.

The ophthalmoscope usually reveals nothing, but it may give objective evidence of the utmost value. In a few cases of traumatic neurosis there has been optic atrophy. Optic neuritis is even more rare, and suggests some cerebral growth or inflammation. Care must be taken not to confuse the redness and obscure outline of the disc seen in hypermetropia for a beginning neuritis.

The field of vision must always be tested, for in many cases of traumatic neuroses it is affected. The rough test with the fingers will do in pronounced cases, but it is of little value in detecting slight changes. The blackboard is better. The patient must sit at a fixed distance from it, within a foot, and the limits of the field be marked out. The perimeter is the most accurate and the quickest method of testing, but it is too expensive an instrument for the general practitioner. The field of simple vision, the field for form, should first be tested, and then the field for colors. It will be remembered that the field for form is the largest, then the field for blue, yellow, orange, red, green and violet the smallest. Hemianopsia is not met with except in disease of the optic tract. A peripheral limitation of the field is a common symptom in traumatic neuroses. If the relation of the color field is disturbed, the trouble is probably genuine. If, on testing, we find the field limited, and its boundary remains the same during our examination, the case is genuine, for from experiment, I believe that it is impossible for the eye to retain a constant imaginary boundary to the field of vision, without some object or mark to aid it. Hence, any marking of the blackboard should be avoided. It must also be borne in mind, that a very marked genuine limitation of the visual field is in no way inconsistent with the patient's getting about with perfect ease.

Hearing. — The hearing should be tested for each ear separately, and the first test should be with the watch through the air. The patient should be turned about to test the other ear, so that the sound may come from the same quarter of the room, and the watch should be held beyond hearing distance and gradually approximated to the ear. If the hearing be good and the speculum reveal nothing, no further tests need be made. If there be diminished hearing and the speculum shows no middle ear trouble, the ear should be closed and the watch held close by the zygoma, and then pressed on the bone. If bone conduction is retained, the trouble is probably outside the labyrinth. Then the time during which the tuning-fork can be heard through the air and through the bone should be noted. In middle ear trouble the bone conduction

is longer. In the traumatic neuroses there is often diminution of hearing, unilateral in hemianæsthesia, but deafness is very rare. Feigned deafness in one ear may be readily detected by plugging the flexible tube of an ordinary binaural stethoscope and making the patient listen through it. By reversing the tubes of the end-piece, the sound can be conveyed to either ear without his knowledge. For further tests, I must refer to the special treatises, but enough has been said to guide the examiner in making a tolerably accurate estimate of the patient's power of hearing.

Taste. — Taste must be tested by applying salt, sweet, sour and bitter solutions to the front and back of the tongue. Loss of taste is rarely noted, except on one side in hemianæsthesia.

THORACIC SYMPTOMS.

Examination of the lungs usually reveals nothing of importance. Examination of the vascular system may afford objective evidence of the highest value. The heart's action is rapid, weak, and perhaps irregular, in the traumatic neuroses; adventitious murmurs are not often present; the pulse may later show signs of arterio-sclerosis; the skin is cold, cyanotic, and at times œdematous. These symptoms are common and, of course, incontestable, and the recent autopsy of a case of traumatic neurosis, by Sperling and Kronthal,[1] shows their importance in the pathology of these disorders.

ABDOMINAL SYMPTOMS.

The patient usually reports loss of appetite, indigestion, and constipation, symptoms of which we can seldom get any objective evidence.

GENITO-URINARY SYMPTOMS.

Disturbance of micturition is not uncommon. As a rule, there is simply weakness in passing water, but occasionally there is actual incontinence. The latter is important, especially if associated with incontinence of fæces, as indicating organic nervous disease. In many cases we can observe the process of micturition, and note the strength of the stream, the existence of dribbling, and the stains and odors of urine on the clothing. If the patient be a man over fifty-five, a soft rubber catheter should be passed after micturition to see if the bladder be wholly emptied, and that there is not the incontinence of retention caused by an enlarged prostate.

Impotence is a favorite symptom in the courts. We cannot test it, and, even when it is present, it has slight value for it may occur from all sorts of psychical conditions, or from simple weakness. Priapism is occasionally a valuable symptom in injuries of the spinal cord.

Menstrual disorders are so common in all conditions of debility, that they afford little information in these conditions. They may possibly be due to some displacement caused by the injury, which can be readily detected by a vaginal examination.

[1] Neurolog. Centralblatt, Nos. 11 and 12, June 1, 15, 1889.

Such then should be the methods of examination. A few words remain to be said in regard to the results and to the important question of simulation.

The diagnosis of the typical forms of nervous disease which may follow injury, transverse myelitis, paralysis from brain disease, neuritis, tabes, etc., is usually compatively easy. It is only in these obscure cases of "concussion," the traumatic neuroses, that trouble arises.

We may, in such cases, obtain certain incontestable objective symptoms: oculo-motor paralysis, immobile or unequal pupils, nystagmus, contractures, muscular atrophy and degenerative reactions, ankle clonus, difference in the reflexes on the two sides, loss of knee-jerks, loss of plantar or cremaster reflex, sharply defined anæsthesia, optic atrophy or neuritis, contracted fields of vision, and disturbances of the circulation.

In the average case of alleged injury to the brain or spinal cord, we may have one or more of these purely objective symptoms, or they may all be absent. We find, moreover, a set of subjective or semi-subjective symptoms, many of which are elicited only by careful search, symptoms not very pronounced, but rather characteristic, and we usually find many such symptoms present in the individual case.

The cases presenting such symptoms, these traumatic neuroses, are usually, I believe, grave, and the prognosis is distinctly unfavorable. It is not my object here to discuss their nature, but such is the opinion of those observers who have studied the subject most thoroughly.

The assumption is often made, however, that the majority of these cases are fraudulent, or vastly exaggerated; that most of the symptoms are simulated, and that the patients get well when damages are paid. After a pretty thorough examination of the recent literature upon this subject, I am rather amused to find scarcely any support for this theory from neurologists. The allegations of fraud and the reported fraudulent cases come from surgeons, and often too from railway surgeons, whose bias is most evident. The surgeon's training and experience has made him familiar with objective phenomena in their most pronounced form; he is seldom an expert in nervous diseases, and, therefore, by his training and mental habit, he is incapable of appreciating at their full value the more subtle symptoms which are often so pregnant with meaning to the neurologist. I believe it incredible and practically impossible that an ordinary man, often uneducated and certainly without medical knowledge, should invent a symptom-complex which is the same in Berlin, in Leipzig, in Erlangen, in Boston, and in country towns in Massachusetts; that this symptom-complex should be made up of a multitude of symptoms, often revealed only on special methods of examination, unfamiliar even to the general practitioner; and that this man should, for hours at a time and on repeated occasions, successfully feign, not only all these symptoms against the keen examination of an expert, but also a perfectly definite and consistent psychical symptom-complex with all its details of expression and manner. As I said in the beginning, the simulator contents himself with a few striking symptoms,

he paints them in flaring colors — not in the subdued tones common in traumatic neuroses — and you never have to search for them.

One argument, in support of the view that most of these cases are fraudulent, is so amusing that I must quote it: "Injuries that are pure accidents, or injuries where a corporation of some character is not at fault. never result in concussion of the spinal cord."[8] The context shows that by concussion of the spinal cord is meant these cases of traumatic neuroses. In the light of reported cases and of the recent contributions to our knowledge of this subject, such a statement can come only from extreme partisan bias or absolute ignorance.

In conclusion I will quote a few words from a recent communication by Oppenheim,[9] whose opinion is based on wide experience, as embodying my own views: "In the majority of cases," he says, "the symptoms unite to form a type of disease which can not, in the present state of our knowledge, be mistaken, from its significance, its clearness, its objective character, and the sharpness with which it is defined. I will state only this, that, in the policlinic, where I examine such cases before a large audience of students and physicians, in almost three-quarters of the cases I develope the diagnosis in a convincing manner on the first examination, so that I often hear the question, 'How is it possible that such diseases could be regarded as simulated?'" In the remainder, he adds, repeated examinations, or the crucial test of hospital residence, will enable the physician to decide.

DISCUSSION.

After the reading of this paper Dr. G. L. Walton made the following remarks:

I am glad to hear the reader state that no neurologist stigmatizes all these nervous cases following accident, as frauds. Such sweeping views do not tend to advance our knowledge of this difficult subject. We should, however, avoid erring in the opposite direction, and assuming, because it is possible for nervous symptoms to follow injury, that all persons claiming such symptoms are genuine sufferers, and that simulation is rare. That nervous shock may accompany and follow trauma is a self-evident fact, and that the innumerable symptoms of nervous debility may persist for a longer or shorter time, either in the form of neurasthenia, hysteria, or hypochondria, is shown by patients who have no claim for damages as well as those who have. It is, however, unfortunately true that many fraudulent claimants assume these subjective nervous symptoms, in lieu of more definite disorder. Our task is to discover, as well as we can, into which category each case falls.

I doubt if general experience will corroborate the statement that most cases, after a temporary improvement following the termination of the trial, grow again worse. I should hesitate to accept a view so widely at variance with that which Page has deduced from a large number of cases observed after a period of years, that the

[8] Judd: Jour. Am. Med. Assoc., August 10, 1889.
[9] Neurolog. Centralblatt, August 15, 1889.

general tendency of these nervous symptoms following trauma, with certain exceptions is toward recovery, after the anxiety attending litigation is over.

As to the question of reliability of evidence given by the family and friends, as compared to that of the occasional observer, I should hardly at once assume that the former was more reliable simply through the greater opportunity for observation; it would depend largely upon the character of the evidence in the given case. For example, if the family testified that the patient had not been able to leave the house for six months, while a neighbor testified to having seen her hang out clothes within that period, it would seem to me that the latter testimony was quite as worthy of consideration as the former, especially if it were apparent that the neighbor had no interest in the case. There are certain symptoms which are of great value in cases where no occasion for simulation exists, which become comparatively valueless in cases under litigation. For example, swaying with the eyes shut is easily simulated, as well as a feeble grasp, whether measured with a dynamometer or by the hand of the examiner. It is also easy to complain of a feeling of constriction about the waist, or of prickling in the course of certain nerves. Nor should I lay too much stress on the theory that no simulant would think of claiming numbness on one side of the body following a blow upon one extremity. Medical literature is easy of access, and persons injured in railway and similar accidents are certainly, no less than other patients, liable to make their complaint a subject of constant conversation, and to gather all available information concerning it. We should also be chary of assuming at once that because a patient claims only *slight* numbness, *slight* weakness, *slight* loss of hearing or vision, that the claim is genuine, inasmuch as this degree of loss of function will naturally be pretended by some who would hesitate to make the bolder claim, as well as by those who realize the greater ease with which such a moderate claim may be sustained under critical examination. In fact, we may be at any time led astray if we have too fixed conceptions of what the modern malingerer will or will not claim, for the knowledge that we have such conceptions may easily serve as a guide to the skilful simulant in carrying out the deceit.

A word regarding the diagnosis of organic from functional disease, apart from the question of simulation. Swaying with the eyes closed, absence of tendon reflex, and a sense of constriction about the waist do not always indicate organic disease. A patient may sway with the eyes closed through simple weakness, the absence of reflex is sometimes found in health, and the constriction about the waist is sometimes complained of in hysteria and hypochondria, as well as in disease of the spinal cord.

MEDICAL TESTIMONY FROM A LEGAL STANDPOINT.[1]

BY H. N. SHELDON, ESQ., BOSTON.

WHEN a physician or surgeon is brought into court to testify, he submits his testimony entirely to the judgment of that court, not only to the presiding justice as to its competence or admissibility, but to the jury as to the credence which it shall receive. And the jury in fixing this credence, in determining the weight which shall be allowed to this testimony and in deciding, as they must, how far they shall follow its guidance, must take into consideration all the facts and circumstances by which either the witness or his testimony is or may be affected. They will look at his honesty; at the opportunities he has had of acquiring information; at his professional skill, the clearness of his vision to observe symptoms and indications, the keenness and trained wisdom of his judgment to draw the right conclusions from those indications; the lucidity with which he expresses those conclusions; the habit of his temperament as a cautious investigator or a hasty generalizer; the bias under which he came to the case by reason of his employment upon the one side or the other; the extent to which his professional pride of opinion has become engaged to support the views which have been advanced upon what he may consider his own side, or to impugn the considerations by which his determinations are sought to be overcome upon the other side. Apart from the attempt to support or to overthrow the main facts and opinions to which he has been brought into court to testify, the efforts of counsel in his examination and cross-examination will largely be turned in these directions; and the jury will look at all these considerations, so far as they have been developed, with whatever assistance may be obtained from the bearing of the witness upon the stand, the arguments of counsel, and the suggestions of the court, and weigh the witness in the balance. They should indeed accept the legal maxim, *cuique in arte sua perito credendum est,* they cannot properly disregard the honest opinion founded upon sufficient premises and intelligibly expressed of skilled experts; but they must themselves pass upon the existence of all these circumstances. Accordingly it is not to be wondered at that very conflicting estimates have been made of the value of medical testimony in a court of justice. Chief Justice Shaw, our most celebrated jurist, and undoubtedly one of the greatest legal luminaries of the world, says that the opinions of skilled physicians coming from persons of great experience, in whose correctness and sobriety of judgment just confidence may be

[1] Read before the Massachusetts Medico-Legal Society, October, 1889.

had, are of great weight, and deserve the respectful consideration of a jury.[2] But one of his latest successors, Chief Justice Chapman, has spoken more depreciatingly of such opinions, on the ground that while they may afford great aid in determining facts, it often happens that experts can be found to testify to any theory however absurd.[3]

One of the judges of the Supreme Court of Maine has said that "if there is any kind of testimony that is not only of no value but even worse than that, it is that of medical experts." And the late Judge Redfield, formerly Chief Justice of the State of Vermont, and distinguished alike as a magistrate and an author, says,[4] that medical experts are beginning to be regarded much in the light of hired advocates, and their testimony as nothing more than a studied argument in favor of the side for which they have been called, so much so, indeed, that it would excite scarcely less surprise to find an expert called by one side testifying in any particular in favor of the other side, than to find the counsel upon either side arguing against their clients and in favor of their antagonists, and calls them "two trained bands of witnesses in battle array against each other."[5] He disavows, indeed, casting the slightest reflection upon the integrity of medical or other experts, and says: "There is little doubt they are as upright and independent as any other class of men. But they are mortal; and being so they are liable to see all subjects through the refracting lens of interest and partiality. They are applied to and employed the same as the counsel, and paid, or should be, for their time in examining the case, at professional prices, and all with a view to find good reasons for bringing the cause to the result desired by those who employ them. It is not wonderful, therefore, that upon subjects of so much uncertainty they should fall into the line of opinion most favorable to that side whose case has been so often urged upon their favorable consideration. In addition to this there will always be such marked conflict in the testimony as to facts that it is commonly next to impossible to know which is right, and the expert is always expected, of course, to assume the theory of the facts maintained by the side calling him. This, of itself, is enough to throw the experts world-wide apart in the results of their opinions and speculations." Judge Redfield illustrates this conflict of testimony by a case tried before himself, in which "a son had subscribed his father's name as surety to his own note, as he claimed with his father's consent. It was claimed in defence that the father had been for years before the date of the note, a mere imbecile and wholly incapable of comprehending any such transaction, as he confessedly was for some years before his death. The testimony was very voluminous and strangely conflicting. It was proved on the part of the plaintiff that the old man understood that his name was to be subscribed to the note, and also that it had been done, that he repeatedly cautioned his son not to let his father be injured by it, and that he told the creditor he was secure, since he had his name, and that he was at the time of the execution of the note abundantly capable of comprehending this and other similar business transac-

[2] Com. vs. Rogers, 7 Met., 500, 505.
[3] Andrews' Case, 356.
[4] Redfield on Wills, 3d ed., 104.
[5] Ibid, 101.

tions. On the other hand, it was proved by multitudes of the most unimpeachable witnesses that for a long time before the date of this note the old man was in the daily habit of doing and saying things which it was not easy to reconcile with any such remaining mental capacity as was requisite to make a binding contract, as that he could not feed himself, did not recognize his own children whom he saw daily, would turn his tea into his plate at table, would get lost in his own house, sit down on the floor, follow his wife from room to room, holding on to her dress like an infant child, exhibiting the most boisterous grief upon the slightest occasion, or none at all, and not unfrequently attempting to build a fire in the middle of the room, with other things too disgusting to be named but strongly indicative of imbecility. . . . It was a mere question of fact, upon the credibility of the testimony on the different sides and no rule of medical law could aid the jury."

On the other hand, it has been well said by Dr. J. J. O'Dea, in the *Journal of Psychological Medicine* for July, 1871: "The expert testimony of medical men is the most important of all, for it requires a most minute, varied and extended knowledge: it frequently relates to subjects of an intricate and recondite character; it is applied to questions affecting the three great interests which men most love, namely, life, reputation and property. Two examples will illustrate its great value. The first is an instance of a crime discovered and of the criminal punished, by the instrumentality of medical science, after all ordinary means had completely failed. In the year 1821, a woman disappeared mysteriously from the city of Paris. A suspicion that she was murdered led to the arrest of several suspected persons, who, however, were soon liberated owing to want of proof of their guilt. After eleven years the remains of an unknown corpse were exhumed in one of the city gardens. They were examined by Orfila, Chevallier, and other famous experts, with the result of identifying them with the published description of the murdered woman, and the re-arrest and conviction of the previously discharged criminals. The second illustrates how an innocent man was perhaps saved from an ignominious death, at least freed from a crushing imputation, by the intervention of the same species of testimony. Thomas Bowman was accused of murdering an illegitimate child by piercing its head with an awl. The skull was produced in the coroner's court, the hole was plainly visible by all the jury. There was no doubt about the case, and the accused was held to stand his trial for wilful murder. The grand jury sitting in Exeter, England, examined the facts and were about to bring in a true bill, when Mr. Seldon, a noted surgeon of the neighborhood, heard what was going on. Suspecting some great mistake, he appeared before the jury and asked to see the skull. Perceiving at a glance that the hole was only a natural opening for the transit of a vein he lost no time in demonstrating it to the satisfaction of the jury, who thereupon procured the honorable discharge of the accused."

In the well-known case of Professor Webster in our own State, medical science was able, from a few charred remains, so far to reconstruct the body of the victim as to furnish that satisfactory proof of his identity without which

conviction would have been impossible. And whenever a dead body has been identified as that of the person charged to have been killed, and the basis of the *corpus delicti* has thus been fully established, the next step in the process, and one which is indispensable to further progress, is to show that the death has been occasioned by the criminal act or agency of some other person. Prominent among the testimony necessarily made use of at this stage of the investigations is that of the surgeons and physicians who have examined the remains, either at the time of the discovery or shortly after. Their testimony as to the appearances observed on such examinations is of the greatest importance, and their opinions as to the cause of such appearances are entitled to the most serious consideration.[6]

But it is perhaps already sufficiently evident that whatever the inherent value of such testimony, it may often be of very great importance. Let us consider what it is and for what purposes it is allowed, and we shall thus perhaps be the better able to determine its true character.

It is a general rule in the administration of justice that witnesses may testify only to facts which have come under their own observations and not to the opinions or inferences which they have deduced from those facts: but upon all questions of science or skill persons instructed therein by study or experience may give their opinions whether derived from facts within their own knowledge or rested upon the observations of others.[7] Whenever the matter of inquiry is such that inexperienced persons cannot probably form a correct judgment upon it, or in other words, when it so far partakes of the nature of a science or trade as to require a previous habit or experience or study in order to the attainment of a knowledge of it, the opinions of experts are admissible.[8]

Accordingly physicians or surgeons may in any case in which they have made such examination as in their own judgment to qualify them to form an opinion, testify to their opinions[9] concerning the physical or mental condition of a person,[10] the cause of death or the cause or effect of an injury,[11] the effect of a medicine or of a particular treatment,[12] or the likelihood of a recovery.[13]

To use the same illustrations which have been collected by the research of a learned writer,[14] they may testify whether or not a woman was pregnant, whether a child was or was not a seven-months' child, whether a certain person was or is sick and with what disease, of how long standing such disease has been, and how far it has a tendency to impair the mind; whether a certain blow was sufficient to occasion death, whether a person found dead on a railroad track was dead before the train struck him, whether certain wounds were inflicted by a sharp or blunt instrument, whether any case of alleged insanity is real or feigned. They may testify as to the kind of weapon or instrument that would produce a particular wound or fracture, and whether

[6] Pitts vs. State, 43 Miss., 472.
[7] Rowell vs. Lowell, 11 Gray, 420; State vs. Smith, 32 Me., 370; Bearss vs. Coply, 10 N. Y., 93.
[8] Davis vs. State, 38 Md., 37.
[9] See Lawson on Expert Evidence, p. 107, whose arrangement is here followed.
[10] Tatum vs. Mohr, 21 Ark., 355; McCurry vs. Hooper, 12 Ala., 823.
[11] Lord vs. Beard, 79 N C., 5; Com. vs. Piper, 120 Mass., 189.
[12] Barber vs. Merriam, 11 Allen, 322; State vs. Slagle, 83 N. C., 630; Wright vs. Hardy, 22 Wis., 348.
[13] Filer vs. N. Y. Cr. Co., 49 N.Y., 42; Wilt vs. Vickers, 8 Watts, 227.
[14] Lawson on Expert Evidence, 106 et seq.

the wound or fracture in question could be made with any particular instrument,[15] whether wounds found upon the head of one deceased were occasioned by his having accidentally fallen into the place where the body was discovered,[16] whether injuries by a railroad accident are, by reason of the great force and violence seriously affecting the nervous system, more severe, though bearing the same external appearance, than those occurring from other causes.[17]

But it must be carefully borne in mind that the law does not attempt to distinguish among skilled experts in any department of art or science. That is a matter which affects the credibility of the witness, and is solely for the consideration of the jury. The law simply says that upon any question of skill or science with which a jury would naturally not be familiar, men who have made the question a subject of particular attention or study, men who have a special practical acquaintance with the immediate line of inquiry, though not necessarily acquainted with all the details of the subject, are competent to give their opinion upon it.[18] The court will not attempt to distinguish between the different schools of medicine, or to recognize practitioners of one class to the exclusion of another.[19] "The law," says a learned judge,[20] "has nothing to do with the merits of particular systems. Their relative merit may become the subject of inquiry when the skill or ability of a practitioner, in any given case, is to be passed upon as a question of fact. But the law does not and cannot supply any certain rules for the interpretation of medical science. It is not one of those certain or exact sciences in which truths become established and fixed, but is essentially progressive in its nature, enlarged with the growth of human experience and subject to those changes and revolutions incident to any branch of human inquiry the laws of which are not fully ascertained. . . . The popular axiom that doctors differ is as true now as it ever was; and as long as it continues to be so, it is impossible for the law to recognize any class of practitioners or the followers of any particular system or method of treatment as exclusively entitled to be regarded as doctors."

Physicians and surgeons of general practice and experience are experts, and may testify even as to matters of medical science which they have not made a specialty, though this circumstance may affect the weight of their testimony with the jury.[21] Complaint has been made that our courts of justice have exercised too little discrimination in receiving as expert witnesses not only all who are called doctors but even sometimes nurses, hospital-dressers, students and quacks.[22] But there is always so much practical difficulty in determining the qualifications of an alleged expert, and the confusion that would arise in the trials of cases from the multiplication of collateral issues is so dangerous, that it is difficult to see how the present latitude given to the discretion of the presiding justice could well be lessened. It is settled, however,

[15] Com. vs. Piper, 120 Mass., 189.
[16] Davis vs. State, 38 Md., 37.
[17] Taylor vs. Railway, 48 N. H., 304.
[18] Page vs. Parker, 40 N. H., 59; Brownell vs. People, 38 Mich., 735; Emerson vs. Lowell, 6 Allen, 145; State vs. Wood, 53 N. H., 484.
[19] Livingston vs. Commonwealth, 14 Gratt., 592; Corsi vs. Maretzek, 4 E. D. Smith, 1.
[20] Corsi vs. Maretzek, ubi supra.
[21] Dole vs. Johnson, 50 N. H., 452; Hastings vs. Rider, 99 Mass., 622.
[22] Beck's Med. Jurisp., 7th ed., 1091.

that the testimony of a medical man will not be excluded merely because he is not a college graduate and possesses no license to practice,[23] or because he is not at the time in active practice.[24] It has even been decided that one may give an opinion on a medical question without being a physician or having studied for one;[25] and it is certain that the necessary qualification may be attained either by study without practice, or by practice without study.[26] But all these qualifying circumstances, though not sufficient to exclude the testimony, may well be considered by the jury in weighing its value, and are accordingly proper matters for investigation by the counsel upon one side and the other; and it has been held that where the opinion of a medical witness is to be based, not upon his own observation or examination of the particular case in question, but upon an hypothetical state of facts presented to him by the examining counsel, a more exact knowledge will be required, and he will not be permitted to testify upon matters of special study with which he has gained no greater familiarity than that of a general practitioner.[27] Subject to this limitation a medical expert may testify to his professional opinion based either upon his own acquaintance with the case under investigation, or upon a medical examination which he has made for the purpose of qualifying himself to testify, or upon an hypothetical case stated to him in court.[28] But he may not testify as an expert upon matters which do not involve the exercise of his professional skill. For example, an expert may not be asked whether certain disturbances of clothes about a dead body indicate death at a particular period.[29] In a trial for murder [30] a physician after describing the wounds which he had found upon the head of the deceased, was allowed to state the shape of the instrument and the direction of the blow that would give such wounds, but not to give his opinion as to the position of the body when struck; because surgeons are not experts in the manner of giving such blows, or in determining how the head must be placed so as most conveniently to receive them, and it is only when the matter inquired of lies within the range of the peculiar skill and experience of the witness, and is one in which the ordinary knowledge and experience of mankind will not enable them to see what inferences should be drawn from the facts, that the witness may supply opinions as their guide. So, on a trial for an alleged rape [31] a physician was not allowed to testify to his opinion that a rape cannot be committed upon a woman who has borne children and who is in ordinary health and strength, without a resort to some other means than the exercise of a man's ordinary physical powers, or to answer the question:[32] "From your knowledge of the human system and of the human frame, as a physician and surgeon, could a rape have been committed in the mode and manner described by the prosecutrix?" because no peculiar

[23] New Orleans R. Co. vs. Allbreton, 38 Miss., 247.
[24] Roberts vs. Johnson, 58 N. Y., 613; Everett vs. State, 62 Ga., 65; Tullis vs. Kidd, 12 Ala., 648.
[25] Re Toomes, 54 Cal., 515; but see Dole vs. Johnson, 50 N. H., 452.
[26] State vs. Wood, 53 N. H., 484; Taylor vs. Railway, 48 N. H., 304; Mason vs. Fuller, 45 Vt., 29.
[27] Com. vs. Rich, 14 Gray, 335; Russell vs. State, 53 Miss., 367.
[28] Bitner vs. Bitner, 65 Pa. St., 347; Hathaway vs. National Ins. Co., 48 Vt., 335: Loening vs. Globe Ins. Co., 10 Hun, 558.
[29] People vs. Bodine, 1 Denio, 281.
[30] Kennedy vs. People, 39 N.Y., 425.
[31] Woodin vs. People, 1 Park. C. C., 465.
[32] Cook vs. State, 24 N. J. L., 852.

knowledge of the human system was involved in the answer. They were mere questions of relative strength or mechanical possibility, which an athlete or a mechanic could have answered as well as a physician, and every man upon the jury as well as either. Still more objectionable, was the request for the same physician's opinion whether, from his knowledge of the female mind and the female system, a woman placed in the situation testified to by the prosecutrix would be more likely to swoon and lose her consciousness, or to be nerved with more than usual strength and power of resistance; both because the express statement of a witness cannot be impeached by a mere opinion that the fact stated is likely or unlikely, and because it is manifest not only that different women would act differently in the same situation, but that the same woman under one state of health or nervous excitability would act very differently from what she would under another state. Nor may medical witnesses give their opinions as to any question of law. They may testify whether a defendant is sane or insane, but not whether he is responsible for his acts; for the latter is a legal, not a medical question, and while experts may testify as to states of mind and conditions of health, the courts must decide whether responsibility exists.[83] For the same reason they may not testify whether a decedent did or did not possess testamentary capacity,[84] for this is a conclusion which the law draws from his mental status, but only to the clearness and soundness of his intellectual powers or the reverse. So in an action for charging a physician with malpractice, another physician cannot be asked for his opinion of the meaning of that word.[85]

Nor may medical witnesses testify to conclusions or inferences which the jury should draw or refuse to draw for themselves. Thus, where one witness has testified as an expert upon a medical point, another witness, though a practising physician, cannot be allowed to give his opinion whether the first witness was qualified to testify,[86] for this would be an invasion of the province of the jury, whose peculiar duty it is to determine the weight to which the testimony of each witness is entitled. In an action against a surgeon for alleged unskilful and careless treatment of the plaintiff's limb, another surgeon may not testify that the defendant possessed more than the ordinary skill of the members of the profession, judging from his acquaintance with him.[87] The jury might well determine whether the defendant possessed that ordinary skill from the facts being stated upon which the witness's own opinion was founded. If the witness knew the extent of the knowledge and skill of the members of the profession generally, he might state the facts constituting the evidence of that knowledge and skill both in them and in this particular individual, and then the jury from his statement might form a correct opinion of the skill of the profession generally and of this individual. So, in an action brought to recover damages for a personal injury which has resulted in death, a physician may not testify to his opinion that the treatment of the disease

[83] Regina vs. Richards, 1 F. & F., 87; State vs. Klinger, 46 Mo., 224.
[84] Arnold in re, 14 Hun, 525; Walker vs. Walker, 84 Ala., 470.
[85] Rodgers vs. Kline, 58 Miss., 808.
[86] Tullis vs. Kidd, 12 Ala., 648; Washington vs. Cole, 6 Ala., 212.
[87] Leighton vs. Sargent, 31 N. H., 119.

after the injury was prudent, and that a change in it would not have produced a different result.[28] The witness might properly state what facts he knew concerning the treatment, and then give his medical opinion upon these facts, or he might be asked his opinion upon an assumed state of facts which the testimony of the other witnesses tended to establish. But he could not answer the general question as to the treatment, because he might base his opinion upon facts which he assumed, but which the jury might not find. A medical man's opinion is competent when the facts upon which it is based are testified to by himself or by others; but his opinion without evidence of the facts is not competent, because he may not assume the facts at his pleasure; they are to be found by the jury; and if they do not exist as he assumes them, his opinion must go for naught.

It must be added that a medical expert cannot be compelled and should not be allowed to answer an hypothetical question so framed as to require him to pass upon disputed facts. Thus, where the question at issue was the sanity of a testatrix,[29] this question was held to be improper, "If the facts stated by the witnesses on the part of the defence touching the physical condition of the testatrix and her symptoms and conduct are true, and the testimony of the witnesses on the part of the plaintiff relating to her conduct is also true, what in your opinion was her mental condition?" because it involved the supposition that the facts tending to show her to be sane might reasonably be accounted for and reconciled with the idea of her being insane, and was really asking the witness for his opinion on the preponderance of the evidence.

But the rules of evidence are all alike in one respect, they are all sometimes violated. The ignorance or carelessness of counsel on one side, the desire of the other side not to insist upon the right of exclusion, the fact that the court will often not interfere of its own motion to exclude even incompetent testimony, sometimes the haste and sometimes the persistence of a witness, will often result in the infraction of all rules. Especially is this the case in expert testimony, under our present system of allowing each party to attempt to bolster up his theory of the case by employing whatever experts he can find able either directly to support his views or to twist the known or admitted facts into conclusions capable of supporting them. The expert witnesses upon one side and the other do, under this system, tend to become trained hands of witnesses, each testifying with the utmost zeal and acumen of professional intelligence, each supporting and prompting the counsel upon his own side in his efforts both by cross-examination and by direct contradiction to overthrow the array upon the other side. This part of the trial becomes an intellectual contest, between each counsel assisted by his own experts and the opposing experts; a contest in which, but for this assistance, the medical side would almost invariably be too much for the legal, and in which, as it is, the result must usually be a more or less distinctly expressed issue between the two arrays of medical talent. Said Cicero, "Nihil tam absurde dici potest, quod non dicatur

[28] Muldowney vs. Illinois Central R. Co., 39 Iowa, 615; State vs. Stickney, 41 Iowa, 232.
[29] Fairchild vs. Bascom, 35 Vt., 399.

ab aliquo philosophorum." There is no theory so absurd that it will not be maintained by some philosopher. The trial of Mrs. Martin's divorce case in Boston, of Mrs. Wharton in Maryland for the murder of General Ketchum, of Stokes for the murder of Fisk, of Dr. Schoeppe in Pennsylvania, the testimony of a New York medical expert to the insanity of both Milton and Whitman, and presumptively of most other poets; the irreconcilable conflict of testimony between medical experts of the most acknowledged skill at the recent trial of Mrs. Maybrick, where the vital question was so befogged that even the verdict of a jury could not command credence; the disputes here in late trials as to the characteristics of menstrual blood, as to the feasibility of distinguishing dried human blood from that of other animals, as to the existence, scope and character of spinal diseases, as to the reality of moral insanity or transitory madness, — all these sufficiently and strikingly illustrate this principle. Look at the specific moral monomanias which were so keenly distinguished from each other, and whose existence was so strongly maintained by expert alienists, who might well be said to be themselves the victims of a monomaniacal monomania, with their pyromania, their toxicomania, their erotomania, their pseudonomania, their oikeiomania, their fanaticomania, and even their politicomania.

We seem then to be justified in saying that the evils by which the value of medical testimony in a court of justice is lessened are mainly two, the learned disagreement of theories, and the stretching and straining of professional skill to reach the result required by the exigencies of litigation. Do not both of these evils spring from one cause, the arbitrary and unrestrained voluntaryism of our system, by which each party selects those and only those experts whose testimony will avail him, and so far as he may shuts the mouths of those equally competent, sometimes more skilled and learned authorities whose weighty opinions would not bolster up his cause? Our courts have found it advisable to refer complicated and intricate matters of account to auditors, whose conclusions are usually found to be of great assistance to the court and jury. Is there any practical difficulty in our following the example set us in some of the countries of continental Europe, and having medical experts appointed by the government, either *pro hac vice* or by some fixed tenure of office, who, after such investigation as might be necessary, should speak judicially and not as hired partisans, and whose reports might be made at least *primâ facie*, perhaps conclusive testimony upon the medical questions submitted to them? I find that in 1874, there was proposed to the legislature of this Commonwealth by the late Professor Washburn as chairman of the committee of the American Academy of Arts and Sciences, and earnestly supported by many of the leading medical societies, a statute of which one section was as follows: "If in the trial of any issue in any of the courts of this Commonwealth the presiding judge shall be of the opinion that the testimony of one or more expert witnesses versed in matters of skill or science, a knowledge of which is material to a satisfactory determination of such issue, may be useful or important in such trial, it shall be competent for such judge, upon the application of either party, and after a hearing of the parties if they shall desire it, to

select and appoint one or more such expert witnesses, and to require their attendance to give testimony in such trial. And the witnesses so selected shall attend and be examined in the same manner as other and ordinary witnesses when testifying on the trial of such issues. The court shall allow such witnesses for their services and attendance in such trial such sums as may be adjudged reasonable, to be advanced and paid as is provided in respect to the fees of ordinary witnesses. And the sums so advanced and paid by either party, if prevailing in the suit, shall be charged by and allowed to him as a part of his costs, as in the case of other witnesses, unless the court for good cause shall order otherwise."

Can it be doubted that the effect of such a statute as this would be greatly to enhance the value and the authoritativeness of the testimony given under it, to increase the facility of obtaining justice, and to lessen the chances of opulent and unscrupulous injustice to befog the remedy against it? Or again, competent experts might be appointed to act in a judicial capacity, and not at all as witnesses, but solely authorized to hear the testimony of such medical witnesses as either party might produce before them, and report their findings to the court. Say Wharton and Stillé, who are among our highest authorities upon such questions, "There would be no difficulty in providing in each county for a county physician who, by the tests of an adequate competitive examination, shall show his general and special competency for this particular post. In addition to the duty developed upon him of conducting post-mortem examinations, and of pursuing any other investigations that may be required in a litigated issue, such a physician might be made the arbiter in those moot questions by which the law has been kept in a state of such distressing incertitude. If a question of this kind arise on the trial of a cause, it would not be inconsistent with the analogies of the law to refer it to an official expert, just in the way that a chancellor sends a question of fact to be determined by a master in chancery or by a common law court and jury. . . . The official physician who acts as referee must be placed under judicial restraints. He should owe his appointment to neither party, but to the State, irrespective of any particular case. His duty should be to take testimony, if needed, on the case, and to hear counsel, so that he will be in no danger of hazarding one of those rash and ignorant opinions which have so much disgraced this branch of medical practice. After thus judicially hearing the case it should be his further duty to certify his opinion to the court by whom the reference is made. In proper cases there might be allowed an appeal from such opinions to a supreme court of governmental experts appointed by the State at large. It may be said that this may be productive of occasional delay. This is true, but the difficulties thus arising would not be so great as those which almost every contested medical issue now involves, and which in cases of insanity have led courts so often to grant new trials from sheer despair of drawing a decisive conclusion from the jargon thus introduced. Soon, also, the delays of appeals would be reduced, for certain cardinal questions would be settled beyond dispute. We should soon know whether there is such a thing as moral

insanity, and whether it is practicable to distinguish human blood after the expiration of a week from the period of its drying. Settle a few such points as these and we relieve justice of a large part of the uncertainties by which it is now beset, and we shall have a series of rules by which cases can be intelligently, consistently and humanely conducted. Nor will this be all. We shall be able to get the judicial utterances of science as to vexed issues of fact, instead of the interested arguments of experts who are virtually employed as counsel by the party calling them or the wild utterances of philosophic monomaniacs who are called simply because of their absorption in some unique theory of their special concoction. . . . Experts as counsel, indeed, will find a proper and important office in presenting the two sides of the issue to the expert who acts as referee; but the expert who fills this last judicial post will be disembarrassed of all personal relations; he will have no client to serve, and no partisan extravagances to vindicate. He will render his opinion as the advocate neither of another nor of himself. When he speaks he will do so judicially as the representative of the sense of the special branch of science which the case invokes, governed by the opinion of the great body of scientists in this relation, and advised of the most recent investigations. When this is done, we shall have expert evidence rescued from the disrepute into which it has now fallen, and invested with its true rights as the expression of the particular branch of science for which it speaks."

Certainly neither of these suggestions would involve so startling a change or so long a step forward as that by which we recently, under the guidance of members of this very Society, disencumbered our judicial system of the whole body of "Crowner's quest" law; and as certainly any reformation which can rescue the testimony of a whole profession, and a profession necessarily both learned and right-minded to the highest degree, from its present distressing uncertainty and point-blank self-contradiction, upon matters of vital importance to the whole community, must be worth some pains to bring about.

WAS IT A MURDER, OR WAS IT A SUICIDE?[1]

A Medico-Legal Enigma.

BY F. W. DRAPER, M.D.,
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Fatal bullet wounds have a kind and a degree of interest peculiarly their own. The medico-legal pathologist finds in their external appearances, in their course through the body, and in the lesions which they leave in the tissues good opportunity for close study; and when he comes upon the need to establish in a doubtful case a post-mortem diagnosis of the manner, as well as the cause, of the death by means of the anatomical appearances which he observes, the study becomes important as well as attractive. Such instances occurred in the admirably reported Dunbar and Lawton cases,[2] of which our Society had the benefit several years ago. I feel warranted, therefore, in asking indulgence for a recital of another example of fascinating difficulty in this class, wherein, fortunately, the issues involved were not serious, but in which the question of the manner of the death, whether by homicide or by suicide, was so full of elements in equilibrium that one of our most conscientious and painstaking justices, after a long and exhaustive inquest, reported that in his mind the decision was still undetermined and beyond his reach.[3] Early in the evening of February 28, 1889, I responded to a summons that I was needed as medical examiner at a certain house in Roxbury to investigate "a case of suicide." Going to the place designated, I found it the scene of much neighborhood excitement, and in the control of several police officers. Upon the floor of a kitchen in a suite of rooms at the top of the house, lay the dead body of a young woman; it was lying, face downward, in a large pool of blood. The head was a foot distant from the rear wall of the room, close to a window; the feet were extended obliquely toward the centre of the floor. The hands and forearms were hidden under the body, and the appearances clearly indicated a sudden death by some form of wounding, the precise nature of which was not at once evident. No weapon was visible; but a small slug of lead found near the feet of the woman, and a wound above her ear and another under her chin, from which latter blood had flowed freely, staining the adjacent skin and clothing, gave an intimation of the cause of the death. At first view, these two wounds, and the bullet suggested a single fatal shot through the head.

[1] Read before the Massachusetts Medico-Legal Society, February 5, 1890.
[2] Transactions Mass. Medico-Legal Soc., Vol. I. pp. 351, 359, and 368.
[3] The final words of the report of the inquest are: "I am unable to decide whether the deceased committed suicide or was shot by her husband."

The clothing covering the body consisted of an ordinary house-dress or wrapper, with neat, well-made underclothing. In the pocket of the dress was a razor, rolled in a small handkerchief. The surroundings of the body gave no indication of struggle or resistance; the furniture was in its proper relations, and a table at the side of the room showed the preparations for the evening meal.

In a front room adjacent to the kitchen, an old woman, of a decidedly hard and austere aspect, was sitting quietly, and without the manifestation of any emotion or excitement. Her manner was singularly cool and mechanical. I was informed by one of the officers that she could tell all about the affair. Here is her story:

The young woman lying dead in the kitchen, she said, was Elizabeth C., her daughter-in-law, seventeen years old. Her son, Edward, and the deceased had been married, much against her (the mother's) will, about eight months previously. She had never liked Lizzie, because of her bad temper and because she had "fits," but she had received the young couple after they had been married five months and they had since that time made their home with her. Lizzie was pregnant. She was often moody, sullen and depressed. She had repeatedly threatened suicide since they came there to live; sometimes it was to be by drowning, again by jumping out of the window, and again by shooting. She had "fits" at intervals so that she had to be held. Her husband was uniformly kind and affectionate toward her, but her behavior was very trying to him and his mother. The day just past was the worst day of all. Lizzie got up about half-past eight, set the table and helped make ready the breakfast meal. Edward declared that he had been unable to sleep, his wife was so nervous. Lizzie ate no breakfast, but during the morning she locked herself into her bed-room and remained there an hour or two. About two in the afternoon she began to exhibit the evidences of her peculiar disposition. She said she would drown herself or would jump out of the window, that they needn't send her to any insane hospital as she would not trouble them another night. These threats were not heard by the husband, as he was out of the room at the time. When he returned, she had gone out with her hat and shawl on. He followed her and overtook her on the sidewalk, as the mother could see from the open window. Edward coaxed her and urged her to go up stairs with him and behave herself. The mother went down and added her entreaties. But Lizzie resisted their persuasion. At length, after a long parley at the street door, Edward put his arms around his wife and carried her bodily up the two flights of stairs, in spite of her energetic resistance, or to use the mother's word "fighting" all the way. Reaching their tenement, Lizzie ran into her bedroom, with the intention, the mother believed, of jumping from the window, but Edward followed her and, bringing her out, seated her forcibly in a rocking-chair. He sat down in a chair, about eight feet away, with a tool-chest between them, and began to coax her in a kindly way, saying, "Why can't you be good?" and using similar words of persuasion, "with tears in his eyes." The mother, meanwhile, was about the kitchen getting the supper ready, the

hour being a few minutes before six. Then, as quick as a flash, Lizzie went into the bed-room, while her husband was in the act of hunting for his slippers in a corner of the room near by his chair and had his back turned toward his wife. Presently, the mother heard the noise of a pistol shot, and turning she saw Lizzie in the act of falling in the middle of the floor with blood on her face. As she turned, she saw Edward standing over Lizzie; he had the pistol in his hand and she thought from his position that he had taken it from his wife's hand or from the floor; on which side of his wife he stood, she did not make clear. He began to bemoan the affair, saying repeatedly, "What shall I do?" Lizzie uttered no words and gave no scream either before or after the shooting. Her son presently went out, taking the pistol with him, but before he went he showed unusual affection toward his mother, embracing and kissing her and saying, "Good-bye." She supposed that he went out for a doctor for his wife. She, herself, in a few minutes, went to a neighbor, a police officer, and told him Lizzie had shot herself. She then returned to her room. Such was the mother's account of this singular affair; her story was obviously inspired throughout by the belief that her daughter-in-law's death was a death by suicide and by that alone.

Meanwhile, another sensational act in this domestic tragedy was going forward. Just before nine o'clock that evening, the occupants of a flat-roofed apartment hotel a mile away from the street where the C.'s lived, heard the sound of a shot which seemed to come from the roof of the building. Going there, they found a young man frightfully wounded in the face, and unconscious. He had a revolver of .38 calibre in his right hand. He was taken down to the street and sent in an ambulance to the Boston City Hospital where he died three hours after the suicidal shot. He was identified before his removal as Edward C., the husband of the dead woman at his home. In his pocket was found a Boston newspaper, one of the evening edition of that very day; on its margin was written with a pencil, the following: "This is the outcome of a villianous life. May it be a warning to others. O good people, don't lay any blame on my godly mother. It is my disobedience to her that has done this. Will some one love her for me?" The only noteworthy feature of the wound in the man's case was that he had placed the muzzle of the weapon in his right nostril and fired upwards and towards the left into his brain, a manner of shooting unique in my experience. The result was very striking. The explosion of the powder had the effect of making a great smoke-begrimed, blood-stained crater of the nasal region, from the frontal sinuses to the upper lip, all this part being completely disorganized. The eyes were uninjured. The bullet made an easy passage upwards into the brain, traversing the left frontal lobe; after breaking, without perforating, the left parietal bone, it rebounded, taking a course downwards and backwards, and was found in the left temporal lobe three-quarters of an inch below the surface.

But although the bullet wound in the case of the man left little that was of medico-legal interest, the autopsy of his wife's body had many important features. The examination was made twenty hours after the death. The body was

well nourished; its surface was pale; the lips and tongue were exsanguine. The face was stained with blood and there was clotted blood in the hair on the left side of the head. Above the left eyebrow were two small, recent ecchymoses. Under the tip of the chin on the right side, an inch behind its edge, was an elliptical contusion, seven-eighths of an inch long, and three-eighths of an inch wide; its long diameter was directed obliquely backwards and at the posterior end of the lesion was a rounded perforation, a quarter of an inch in diameter. Into this, a large probe entered freely and took a direction outwards, backwards and upwards, parallel with the inferior edge of the lower jaw. All around this wound, including the entire submental region, were a great number of black dots and short red lines; the latter had a direction from left to right and in length did not exceed one-sixteenth of an inch. There was a slight periphery of redness around the oval ecchymosis, but no sign of smooching, or burning, or of the 'brand' described so graphically by Dr. Fish.[4] It was a bullet wound whose appearances corresponded with experimental shots made with the muzzle of the revolver placed from twelve to eighteen inches distant from the entrance wound.

The right side of the neck was moderately swollen.

Just behind the right mastoid process, there was an oblique fusiform wound in the skin, having all the external appearances of a punctured or incised wound; it measured three-quarters of an inch in length, and a probe, passed into it, took a direction through the subcutaneous tissues toward the wound in the chin. This wound deserves some attention because it had nothing about it externally to suggest the exit of a bullet at that point, but on the contrary had all the features of a cut.

On the left side of the head, four inches above the external auditory meatus and half an inch in front of the coronal line, was a penetrating bullet wound of the scalp, an eighth of an inch in diameter, with a narrow ecchymosed periphery. Around this, in the scalp, over an area three inches in diameter, were many impacted, black powder grains, but not the slightest singeing of the hair, or smoking, or burning of the skin.

Here, then, were three external wounds, — two on the right side of the head and one on the left; two of them showing the evidences of a pistol-shot entrance wound, and suggesting a near, but not very near, approximation of the muzzle of the weapon to the skin, and the third giving all the features of a lesion with a cutting instrument.

The internal appearances were not less interesting. Dissection of the right side of the neck demonstrated that the wound under the chin was connected with the wound behind the right mastoid process by a ragged and blood-stained track which passed through the right submaxillary gland, behind the right sterno-mastoid muscle, through the anterior segment of the internal carotid just above its junction with the external carotid, through the internal jugular vein, and out at the posterior edge of the sterno-mastoid near its insertion at the mastoid process. The tissues at each side of this bullet track were fully

[4] Transactions Mass. Medico-Legal Soc., Vol. I, 279.

infiltrated with blood, and the staining from this source extended as low as the right clavicle.

The wound on the left side of the head opened upon equally striking appearances. The bullet took a course obliquely from left to right in a vertical plane nearly parallel with that of the wound in the neck; but it was directed downwards, rather than upwards. It made a small perforation in the scalp, caused a symmetrical rounded opening through the skull five-eighths of an inch in diameter, with considerable bevelling of the inner table; entered the left hemisphere just in front of the fissure of Sylvius, took its way through this side of the brain in an oblique direction downwards and backwards, emerged at the posterior tip of this hemisphere; passed through the dura at the torcular Herophili and rested in the right occipital fossa close to the wound in the dura, where it was found as a distorted slug. Its track through the brain was four inches long, blood-stained and with soft, disorganized periphery; scarcely any blood was extravasated between the scalp and the skull or within the skull upon the brain.

The examination of the rest of the body gave unimportant data. The organs were anæmic but otherwise were normal. The womb was enlarged to the size of a large football and contained a normal fœtus representing about eight months of pregnancy.

Such were the appearances developed by the autopsy. In their presence, I felt justified in reaching a conclusion which the facts then in my possession, derived from personal inquiry, did not seem to me effectually to control or contradict; and that conclusion was that the woman came to her death, not by her own act, but by the act of another person. Viewed as a purely medico-legal problem, the data at hand appeared to justify such a diagnosis. Acting in accordance therewith, I reported the case for inquest.

This judicial inquiry was thorough and exhaustive. It brought to light several important facts having a direct relation to the case, but singularly enough they did not greatly aid in solving the main question of the manner of the death. I will give the principal points in the testimony.

With regard to the woman's suicidal tendencies and purposes, one of her neighbors, a young woman, testified that she had heard Lizzie repeatedly lament her pregnancy and declare her purpose not to live to bear the pain of child-birth. Another said that on the day of Lizzie's death, at about two in the afternoon, just before the scene on the stairs, she had asked for the loan of a razor "to cut her corn." It appeared also that she had tried to get a razor at two other neighbors shortly before this day, and she had obtained one, but this was secured by Edward's mother and returned to its owner. Several testified that they had observed her moody and morose behavior. The razor found in her pocket was identified as her husband's; when she got it did not appear.

As to the relations between the husband and the wife, nothing was brought out at the inquest to indicate that on his part there had been any unkindness, or violence; it was shown, on the contrary, that he had been of a pleasant

disposition and the blame of the domestic unhappiness was placed by the witnesses upon the wife only. Even in the scene on the stairs, he was not observed by the neighbors to use force, as if in anger; and one of them heard him say as he carried her up, "You are a witness that I do not hurt her."

As to the ownership of the pistol, Edward's mother testified that it belonged to Lizzie, that she had it in New York and used to sleep with it under her pillow, that she had threatened to shoot herself with it; and that lately it had been kept in the son's trunk. Of the pattern of the weapon I cannot give a description, as I did not see it. I infer that it was self-cocking.

A neighbor living on the floor below the C.'s heard two shots and then a sound as of a fall at the time of the affair; the interval between the shots was short, and that between the last shot and the fall was a longer one. Edward's mother modified her previous statement to me and swore that she heard two shots with only "a second" between them. As she turned, she saw the room full of smoke and Lizzie falling with a groan.

Upon the very important question whether Lizzie was left-handed, the evidence was not uniform or conclusive. Her own mother was sure that she was right-handed. Edward's mother testified that she couldn't tell whether she was right-handed or left-handed; she was "handy" with both hands. She stated in corroboration of this that a few days before her death Lizzie had cut her right thumb accidentally and Edward had made a cot for it. At the autopsy a rude covering was found on the tip of the right middle finger, and close to the nail was a small wound in the skin suggesting, not a cut, but a bruise. Another woman, a friend of Lizzie's who knew her well, swore positively that she was left-handed, and that she had seen her cut bread, stir up cake and sew with her left hand; but she had heard Lizzie say that she could use both hands with equal ease.

Concerning the husband's behavior at the time of the shooting and immediately after, the mother's recollection, as she expressed it under oath was somewhat different from her statement to me at the first interview. She said at the inquest that, just before the shooting, he sat at one end of a tool-chest in the kitchen and Lizzie was at the other end with her right side toward him. When she (the mother) heard the shots and turned, she saw Edward stooping over his wife with the pistol in his hand and she "supposed he had just picked it up." He said presently, as he stood by his wife's body, "My God! mother, it's done! What shall I do? What shall I do? I shall be blamed for it! They'll say I did it! And I shall be hung!" Soon he went out after kissing her and saying "Good-bye." At the street door one of the neighbors spoke to him and he said to her that Lizzie had shot herself and he was going for a doctor.

It became rather important, in view of Edward's self-accusation, to trace his previous history in order to determine if that would tend to make a foundation for the imputation of blame which he anticipated. It transpired that he had been convicted of burglary and had served a term in prison for it; and that at the very time of the shooting he was suspected of being concerned in some recent burglaries in an adjacent town.

You now have all the facts relating to this woman's death, so far as I know them. I do not propose to enter upon a discussion of them although they supply abundant and excellent material for extended comment. I prefer to place before you a summary of the data and leave the question of diagnosis to you, merely remarking that if Edward C.'s shot into his own head had not been fatal the problem would have been infinitely more grave than it now is and would have placed upon the medical examiner a degree of responsibility almost without precedent in criminal jurisprudence. I shall arrange the data as impartially as I can in two groups, accordingly as they seem to favor the theory of homicide or that of suicide.

The facts which support the theory that the case was one of suicide are these:

(1) The woman's disposition and unhappiness in her home.

(2) Her pregnancy and dread of its culmination.

(3) Her repeated threats of suicide and her special threats on the day of her death.

(4) Her attempts to secure the loan of a razor under false pretences.

(5) Her ability to use her left hand and her right hand with equal facility.

(6) Her violent struggle with her husband when he carried her forcibly up stairs after a prolonged attempt to persuade her to go up peaceably, supplying thus an immediate impulse to destroy herself.

(7) Her position with relation to her husband as she sat by the window in the kitchen just before the shooting, presenting her *right* side to him while the shots both came from the *left*. [This is on the supposition that the mother's testimony at the inquest is the more reliable of her two statements.]

(8) Her ownership of the revolver and her threats to use it on herself.

(9) The razor in her pocket at the moment of her death.

(10) The absence of any scream of terror such as would naturally occur if her husband approached her with a pistol presented to fire.

Then, as to the husband:

(11) His uniform demeanor of kindness to his wife.

(12) His endeavors to dissuade her from her violent purposes.

(13) The absence of any adequate motive impelling him to kill his wife.

(14) His first words after the shooting, — quite as consistent with the theory of suicide as with that of murder.

(15) His words to the neighbor as he left the house.

(16) An adequate and reasonable explanation of his own suicide found in his realization that his known past history would tell against him overwhelmingly.

(17) Finally, as to Edward's mother, the only witness of what transpired in the kitchen, should have some weight attached to her consistent and unwavering belief that the death was by suicide, and that her son was innocent.

On the other hand the theory of homicide has these considerations to support it:

(1) The sex and youth of the deceased. A girl of seventeen, however strong her impulse to kill herself would not probably choose a revolver for

the purpose, suicide by pistol shot being a very rare form of death among females.

(2) The open threats of suicide. People who kill themselves rarely give notice of their intention openly and repeatedly; they *attempt* suicide but do not otherwise betray their purposes.

(3) The number of the shots.

(4) Either of the wounds was of so grave a character as reasonably to prohibit, if not absolutely to prevent, a second shot, especially with the weapon in the hand of a girl.

(5) The direction of the wounds from the left to right; there should be the strongest evidence that the girl was left-handed if the theory of suicide is to be accepted, and even with such a presumption established, the shots would be awkward.

(6) There was no burning or powder smooching or smutting of the skin around the wounds of entrance, such as shots from the same weapon left about the wound in the husband's face.

(7) The appearances of the wound on the chin indicated a distance of at least twelve inches between the muzzle of the weapon and the skin.

Then, as to the husband, these incidents in his conduct have an obvious relation to the case:

(8) His failure to interfere and overcome his wife before the second shot was fired, the interval being sufficient for such interference if we assume that the weapon was in her hand and not in his.

(9) The pistol was in *his* hand at the moment when the mother turned and before the wife, in her falling, had reached the floor.

(10) His violence to his wife a little while before the shooting, following his complaint in the morning that her nervousness had kept him awake.

(11) His criminal record.

(12) His self-accusing words over his wife's body.

(13) His immediate flight with the weapon in his possession.

(14) His dying message on the newspaper margin.

(15) His own precipitate suicide, obviously determined upon when he bade his mother good-bye.

(16) Finally, the mother's evident and natural bias in favor of her son and her admitted prejudice against his wife are an adequate basis for the presumption that while she honestly disclosed many facts in the case, she distorted others and successfully concealed still others.

Now which of the two theories has the firmer foundation in facts? Was it a case of suicide or was it a case of murder?

APPENDIX.

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TRANSACTIONS

OF THE

MASSACHUSETTS

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MASSACHUSETTS MEDICO-LEGAL SOCIETY.

REGULAR MEETING, WEDNESDAY, OCTOBER 7, 1891, DR. F. W. DRAPER, PRESIDING.

Dr. C. C. Tower read a paper on Sudden Death from Diseases of the Organs of Circulation.

DISCUSSION.

DR. A. H. JOHNSON:—I am very glad that the Society has undertaken to discuss this question, especially as we now have upon our reports so large a number of deaths from heart failure, a phrase which is getting to be extremely objectionable. It is so liable to abuse that it ought to be ruled out by the boards of health, and not received as a proper return. We might as well say, died from want of breath. There is something else back of the heart failure, and it is the physician's duty to use every means to discover it, and in the absence of a discoverable cause, it is a great deal better to admit ignorance than to cover that ignorance by such a phrase as heart failure. The objection to the use of the phrase is that it encourages carelessness, and stands in the way of careful investigation.

I have seen returns of heart failure, when it seemed to me perfectly clear that this organ, which was secondarily disturbed, should not have been mentioned as the cause of the death. For instance, I have known of cases of pneumonia where the death of the patient has been attributed to the weakness of the heart. Yet, had no pneumonia occurred, the heart might have carried the man through a long life. I have in mind a recent case in which the patient was taken with cholera morbus, sick for somewhat over forty-eight hours, rallied well, gained gradually for a little over ten days—I cannot be exact about the time. During his convalescence he had more or less diarrhœa, which gradually slackened. One day, regarding himself so nearly well that he thought on the following day he would be out, he took a bath, walked about the house, and in the course of the evening felt distress in the epigastrium, and before the physician could arrive, died. The death was rendered as due to heart failure. Now there were antecedent causes enough to produce anæmia of the nerve-centres,

a great state of exhaustion which had not been recovered from, and a temporary exaggeration of distress, together with distension of his stomach, might be enough to arrest a feeble heart.

Similar illustrative cases might be narrated at great length to show that the term "heart-failure" is being improperly used in records of mortality, in the place of the name of the disease, or pathological condition, or shock, or other cause which inhibited the heart's action.

DR. E. G. CUTLER: My personal experience embraces only a few cases of sudden death by heart disease, and in each, previous symptoms led the person to seek medical advice. Two cases of aortic regurgitation and one of atheroma of the coronary artery, were sudden. Two of ruptured heart and one each of rupture of the mitral and rupture of the aortic valve, were followed by death within a few hours. The cases were as follows: In the two from aortic regurgitation there was advanced disease, and in each the person was stricken while pursuing the usual occupation. There had been a history of pain in the praecordia, dyspnoea on exertion, occasional faintness and inability to do full work, as was afterwards learned. In one there was found, on post mortem examination, considerable narrowing of the orifice of one coronary artery, in addition to the disease of the aortic valves. The case of sudden death from atheroma of the coronary artery occurred in the practice of Dr. Morrill Wyman. The patient had suffered some attacks of angina, pain along the left arm, inability to go up stairs or a hill except slowly, and death occurred while he was standing up before a glass to shave. At the autopsy I found the anterior coronary artery nearly occluded at its orifice by an old atheromatous process. The muscle of the left ventricle was quite fatty. In both of the ruptured heart cases a thrombus was found in the coronary artery where the artery was much narrowed by the atheromatous disease. In each instance the case had been under treatment a relatively short time, and death followed a few hours after severe symptoms set in. In one case rupture occurred in the right and in the other in the left ventricle. The death from rupture of the mitral valve occurred in a laborer, previously healthy, who was precipitated into a trench, and suffered immediate pain, dyspnoea, and cyanosis, followed by death in a few hours. At the examination it was found that a portion of the mitral valve had been torn away from the papillary muscles, which were seen to be markedly fatty. In the rupture of the aortic valve the case had been in the hospital for aortic disease once before, and had been discharged—relieved, and able to do some work at home. She returned some weeks later with a history of sudden acute praecordial pain, dyspnoea, intense cyanosis, and died within a very few hours of the onset of the symptoms. At autopsy, besides the old thickening and shortening of the aortic valves, one curtain was found to have been torn away, and hung by a narrow strip only.

DR. J. A. MEAD: I received a letter from the President Monday, asking me if I would be willing to give the Society a short account of Dr. Hosmer's case. Dr. Hosmer lived some two years after his first shock, but his death was sudden. In 1889 he was suddenly stricken down while riding about in a buggy; remained in bed seven weeks, during that time being almost entirely paralyzed on the right side, his leg recovering gradually. At the twelfth week he was up walking about a very little with crutches. During that time he went on gradually improving, his great trouble being aphasia. That was the most noticeable thing during the six months previous to his death—his inability to find the proper word. Sometimes he would talk very well for several days, and then would come a period of a week when he could hardly make himself understood intelligently. He recovered so far as to go about considerably, seeing some of his old patients, a few of them professionally, and was enjoying life in a medium sort of way, attending some of the meetings of the historical society of which he was president, and it was at this society that he made his last appearance, which was just a week before he died. Against the wishes of his family he insisted on walking to the house where the meeting was held, which was half a mile from his house, and there was quite a hill for him to ascend. He staid until ten o'clock, and returned, seemingly in his usual health, but after a half hour was seized with very severe pain in the region of the heart, and he sent for me at once. I immediately injected morphia, and it took nearly three-fourths of a grain before he was quiet. He slept during the night, and the next morning was free from pain, although very anxious and somewhat distressed for breath, yet very comfortable. That night at ten o'clock he was again seized with excruciating pain, which was again relieved by morphia. He had one more such attack as that, and that was relieved by morphia. Each time he got relief from these paroxysms, and had ten or twelve hours of comparative comfort. His condition was one which caused great anxiety to Dr. Minot and myself. There was a slight dullness at the base of the right lung, his pulse was rather rapid, and he had a temperature of about 101; but his countenance was bad, and he seemed to be a very sick man. At seven o'clock of that day he died, sitting on the edge of his bed—he suddenly fell back and died at once. The autopsy was held two days after by Dr. Whitney.

DR. W. F. WHITNEY: I have very little to add to the case of Dr. Hosmer, which Dr. Mead has just reported. The interesting feature was the undiscovered dissecting aneurism, evidently of rapid formation and undoubtedly dated from the time of the last seizure. The atheromatous disease of the aorta must have been of long standing, but the sudden giving way of the aorta and formation of dissecting aneurism followed as soon by its rupture into the pleural cavity, is rather a rare occurrence.

On the general subject it seems to me, as Dr. Tower has said, that most persons who die suddenly, and the cause is referred to the heart, are really sick people, but from their blunted susceptibilities and usually poor surroundings their condition is not recognized by those about them. In speaking of sudden death from disease of the heart, I think that the records of autopsies which have been made on persons who have died suddenly, where disease has been recognized before death, in all probability throw sufficient light on the subject to account for most of the cases. The sudden deaths as we meet them in the hospitals and elsewhere, and of which I think Dr. Cutler practically gives the essentials, are those of sick persons, where there seems to be no reason why they should not live quite a long while, but die suddenly. Such a death from heart disease I think is to be attributed to an accident, which may occur in the heart itself, or one which may come in some other organ of the body, the heart of course being primarily diseased. The diseases of the heart proper which would produce a sudden death, are well stated in Dr. Cutler's paper. First, rupture of the heart itself, which follows, as a rule, disease from obstruction of the coronary artery, where the tissue of the heart has either quickly become necrotic, or cicatricial tissue formed with subsequent dilatations (what is termed aneurism of the heart), and finally rupture.

The other accident in the heart which may produce sudden death, is rupture of the valves, either one or more of them, and that may come at times quite suddenly, and from extra stress. Apparently, the case of Dr. Cutler's, is a very rare one of direct rupture of the heart's muscle, associated with violence. Where there is fatty degeneration of the heart, if great stress, as in extreme exertion is put upon it, it may become so filled with blood as not to be able to empty itself, and in this way the patient may occasionally die suddenly.

Secondary embolism from primary unrecognized heart disease might cause sudden death, but it would be more apt to produce partial paralysis or other symptoms that would hardly come under this head.

In one case on which I made the autopsy at the hospital, last week, an embolus in the heart was the cause of death. The case, briefly stated, was one of simple fracture of the lower bones of the leg, with no reason to suppose the case would not go on perfectly well. There was a good deal of ecchymosis. Four or five days after, the nurse was moving the leg on a pillow, when suddenly the patient complained of a pain shooting up through the thigh, which he finally located in the sternal region, had a few convulsions and died. At the autopsy liquid blood was found everywhere, except in the right side of the heart, where curled up was a long thrombus, which, stretched out, measured a number of inches in length, with one end in the right pulmonary artery. The further dissection of the leg failed to reveal

any thrombus of any of the large vessels, and it is to be supposed that this long thrombus had formed in the veins, became detached and sucked up into the heart, where it had almost half filled the right cavity, and caused sudden death in this way. It is an extremely rare accident for such a large thrombus to be dislodged and sucked up into the heart and cause death. Really it seemed more like a case of embolism of the heart rather than embolism of the lung, from the amount of the clot which was in the heart. That was the cause of the sudden death, but there was violence which preceded.

The cases of sudden death which can be directly attributed to the heart itself are few in number and almost entirely covered by the cases represented by Dr. Cutler's observation.

As regards pulmonary apoplexy, I hardly think that would come under the head of sudden death from disease of the heart.

I will say that repeated examinations of the heart and kidneys for the first year showed no disease whatever. They were examined by half a dozen different doctors, including Dr. Edes of Washington. Nothing could be found in the heart or lungs, but about two months before his death very slight traces of albumen were found, but never any casts.

Dr. B. E. Cotting: I do not think I can add much to what has already been said, but there is a condition I happened to fall in with once that has not been mentioned. A gentleman who was never known to be sick, one bright moonlight evening, after a large supper and chat with his family and a few of the neighbors who were passing in and out, said he felt very well, much better than usual, that he would take a little stroll; took his cane and walked perhaps one-third of a mile. It was a pleasant evening, and the people of the house near by, a little back from the street, noticed there was a sudden fall of an individual on the sidewalk, went out and found the man dead. As soon as possible he was removed to his residence, and in the course of proper time Dr. Ellis made an examination of the body. Nothing appeared wrong in the heart, except that it was of a consistency and softness of putty. We passed our fingers through and through the substance of the heart as we would a mass of putty. I should like to hear Dr. Whitney's explanation of that state of things, and that was the only thing we could find. The heart was not unusually full.

I once saw a case where a lady was dining out, and after the dinner, feeling uncomfortable, she took a carriage and drove home, which was a few rods from my own house. She stopped at my house, and said, "Come to me as quick as possible." I went in to get my hat, and she told the driver to drive on, she could not wait. I followed as rapidly as I could, and as I neared the house I saw her being almost lifted by the driver into her house. When I arrived there she was

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Frederick Winsor, M.D.	1877–1879
Samuel W. Abbott, M.D.	1879–1882
Joseph G. Pinkham, M.D.	1882–1885
Benjamin H. Hartwell, M.D.	1885–

RECORDING SECRETARIES.

Robert Amory, M.D.	1877–1879
Charles C. Tower, M,D.	1879–1882
William H. Taylor, M.D.	1882–

TREASURERS.

Robert Amory, M.D,	1877–1879
Charles C. Tower, M.D.	1879–

I said this man died suddenly. He must have had a tremendous apoplexy, and if that is the case, the blood will gravitate by turning him over in such a way as to show itself. After holding him head down for a period of five minutes, I turned him back and opened his eyes. The right eye was completely injected. The left eye retained its natural color.

Another case was that of a stout plethoric woman who got up in the morning in her usual health and prepared to go to church. She took breakfast and her husband went out to get the team. When he came back into the kitchen she lay on the floor stone dead. I first gathered the history, which was that she had had repeated attacks of faintness, falling in a dead faint, shortness of breath and other symptoms of heart disease. Of course with such a history, I was fully prepared to make my diagnosis, that the woman died of heart disease. The body lay on the floor just as it had lain since the accident. I turned her over and looked at the face, and it seemed there was a little discoloration of the left eye, and I passed my hand over the eye and along the side of the skull and detected a *fracture*. There was a depressed fracture of the skull directly over and a little outside the left eye. I then looked over the ground and saw how this happened. It was evident enough the woman had not been foully dealt with, and I found she had probably been taken with one of her faint fits and fallen and struck upon a little window-ledge which stuck out. I saw the very point upon which she struck. She fell and broke her skull. I think undoubtedly that was the cause of death. There was a clear case of heart disease, but the woman was killed by the blow which fractured the skull.

The other cases I have here have no special interest that makes it necessary to go over them. There are in all twenty-one.

I have one case here of heart disease not connected with anything else. I have reported heart disease and apoplexy in some cases, heart disease and pulmonary embolism in some cases, or pulmonary apoplexy. There is one case here which I have reported as death from heart failure. I want to explain why I say that. Here was a man supposed to be in perfect health, though old and feeble, who got up and without taking breakfast, being in a hurry to get to the train, mounted his team and drove two miles one cold morning. He had some trouble with the horse. On arriving at the store he went in to get warm. His head fell on his breast and he died. He was seventy-three, a farmer. The question arose, what killed that man. He died, not because his heart was diseased, for there was not a particle of evidence of that, but he overtaxed his heart. He made his heart work harder than it could, and it had broken down.

Dr. D. W. Hodgkins: I have had in my practice as medical ex-

aminer, quite a number of cases that I have reported as heart disease, some of them where I have been thoroughly and fully satisfied that heart disease could be fairly put down as the cause, and others, as has been remarked by Dr. Adams, where there was some doubt about it, and I have found the same difficulty which I suppose we all find where the friends object to having autopsies made, where the cause of death seems to them plain. I think perhaps we ought to take into account more fully the conditions of the system that produce this condition of so-called heart disease. I suppose it is the experience of all the gentlemen present here and of the profession generally, that we find a great many people complaining, even young people, of palpitation and weakness of the heart, and we apply a stethoscope and listen, and find no evidence of any organic disease, but the heart is acting very peculiarly. Now I find this in a great many young men who work in shops and factories, who use tobacco to great excess. We term it the tobacco heart. I think it is getting to be a very common thing. Now here is a process which commences in youth. The foundation is laid for serious trouble later on. Then they die from heart disease, we say. It is the last act in the drama of life, and a great many times the sudden attack which causes the death we report as heart disease because it is the last thing, but there are causes perhaps in the liver, perhaps somewhere through the intestinal viscera, where the circulation is interfered with. There may be an interference with the circulation in the lung, which caused this extra strain upon the heart, producing the fatal result.

There is one point in regard to making the returns of death in general practice. We have a blank with a space perhaps only an inch or two long in which to write the cause of death, and the registrars wish us to state the cause of death in one word if we can; and it is not always easy to get one word or two words which can convey to the registrars, or to any person intelligently, all the causes which preceded, which have led up to this point where the overburdened, weakened heart simply stops. What is the cause of fatty degeneration? Possibly we can't tell. A man dies of pneumonia and the returns put it down that he died of heart failure,—a most unsatisfactory term, and yet the heart failure was the last act in the drama, and that is what sometimes we are compelled to report.

Dr. Cotting: Dr. Adams' case, where he says a man driving through the streets died of heart failure, suggests to me, does anyone know what happens to an animal that is overdriven till it drops dead, what changes take place in that creature which cause the death? I remember the instance of a horse being driven something like a hundred miles in a day and dropped dead, and it was said his arteries were as red as crimson velvet all through, and that was all the account

I heard of it. Can any one here tell what really happens in such a case?

Dr. Johnson. In reference to Dr. Adam's case, I should much prefer to have the cause of death assigned to senile exhaustion. The patient was evidently prematurely old, and easily exhausted, the heart admittedly healthy.

Dr. Adams: He was an old man but in very fair health,

Dr. Johnson: I think the true cause of death was exhaustion from overstrain of the whole system.

Dr. Adams: So far as I know the heart was healthy. He never had complained of any symptoms referable to the heart; never had nosebleed, cyanosis, fainting fits, shortness of breath,—anything of that kind. That there may have been disease of the heart, I am not prepared to deny, but there was no proof. In the absence of proof of existing disease of the heart, exhaustion was to be regarded as the cause of death. Now then, what organ was most likely to have been active in causing the death? The heart, evidently. Call it heart exhaustion, if you will. I called it heart failure. I could not see any other way of explaining the death. I gave it with great reluctance. It seems much like saying, died from want of breath; but in this case it seemed to me justifiable to use this term. That may have been an error in judgment on my part.

ABDOMINAL AND PELVIC EMERGENCIES CAUSING SUDDEN DEATHS.[1]

BY J. C. IRISH, M. D., LOWELL, MASS., AND A. K. STONE, M. D. BOSTON.

The chief duty of the medical examiner, and what he especially owes to the State, is to make inquiries into each case to which he is called, why the State has lost its subject. When he can say that the State has lost its subject through nobody's fault, his investigation as medical examiner has ceased. The State is not interested to know of what one subject or another has died, only that there has been no foul play. It simply limits its inquiries by its desire to know whether it has lost its subject by the fault of another.

Now, in the number of cases in which a medical examiner is called during the year, there will be but a very small percentage in which the State has lost its subject by the fault of another; probably not one-tenth of them. Therefore in the remaining nine-tenths, when the medical examiner has established the fact that death was due to natural causes, one portion of his duty is fulfilled. In addition, however, he is not only to find that these subjects died from natural causes, but also to certify of what particular disease they died.

Hence, in connection with our office we are confronted oftentimes by simple, sudden deaths, with no preceding history of any illness in the few hours previous to death. For instance, the patient has gone to bed apparently well, and is found dead the next morning, and we are asked to decide what was the cause of death, or its most probable cause. This is one of the questions that we must answer to the best of our ability, and answer oftentimes with the aid of very little evidence.

So far as our absolute knowledge goes, we do not know the cause of death in many instances, and we have not data enough to make a reliable or probable conjecture as to its cause. Yet there is no suspicion that the deceased came to his death by anything other than by natural causes, so there is no reason for asking for an autopsy. Fortunately, however, we often have the preceding history perhaps of one or two days' illness, which was not thought to be dangerous, to give us very considerable aid in forming our conclusions, and in those cases we are able to sign the certificate of burial intelligently, and probably correctly.

1 Read before the Massachusetts Medico-Legal Society, February 3, 1892.

Still, as I have said before, there are very many of them in which the cause of death, is a matter of mere conjecture, which is entirely unsupported by any testimony. It therefore behooves us to investigate with all possible care the various causes of sudden death, and whatever investigation can throw any light on these various causes is of great assistance, and of great value in aiding us to arrive at correct conclusions in particular cases.

In the subject which has been assigned to me to-day, there are very many interesting inquiries to be made. The experience of any one man as to what causes sudden death due to any accident occurring in the pelvic abdominal cavity must be very slight. The ordinary practitioner, or medical examiner, who has seen two or three such cases, has had really a very large experience. Therefore, in drawing any conclusions upon this subject relative to the frequency of those accidents, or, upon the occurrence of any given case, it is simply necessary to investigate as thoroughly and exhaustively as possible the combined experience of all our writers. I therefore avail myself of the recorded experience of others that has come readily within my reach.

It is not my purpose in this paper to touch upon the subject of hæmorrhages into the pancreas, which has already been treated so ably and exhaustively by the President of this Society, Dr. F. W. Draper. Neither do I intend to consider abortion, for complicated as it is with questions of law and morality, it deserves a place entirely by itself in the transactions of this Society. I shall, however, call your attention to-day to those non-traumatic conditions in the abdominal cavity and plevis which may cause death in such a manner as to demand our attention.

I shall run over briefly the cases which have come to my notice in glancing over the literature of the subject, and then add a few cases which have fallen under my own personal observation.

First of all I shall take up the cases which have occurred in the course of typhoid fever, where death has occurred in the so-called walking or ambulatory cases.

Dr. Fitz[2] in his recent investigations upon the subject of perforations has collected 4,680 cases with 5.58 per cent. of perforations, thereby agreeing with Holscher[3] whose report of 2,000 cases observed by him showed perforation in 6 per cent. of the cases. Murchison[4] gives a percentage of nearly double this, while Schulz[5] and Liebermeister[6] in the hospitals of Hamburg and Basle report a percentage of only 1.2 per cent. and 1.3 per cent. respectively.

2 Boston Medical and Surgical Journal, October 1, 1891.
3 Munch Med. Woch., 1891, xxxviii, 64.
4 Murchison: Treatise on Continued Fevers.
5 Schultz Cbl. fur. Allg. Path. u. Path. Anat., 1891, ii, 289.
6 Ziemssen's hbd. d. sp. Path. u. Thera., 1874, ii, 1, 161.

All these taken together would make a trifle less than 5 per cent. in a total of 14,087 cases. What the exact data from which Dr. Fitz obtained his 4,680 cases, is, we have no means of knowing, but it would seem from a number of other statistics that we have seen, that he made no attempt to tabulate all that has been written on the subject, and that if all were collected, that the percentage would be on the whole less by one or two per cent. than the 6.58 per cent. which he is inclined to consider the true percentage of perforations. But whatever the real percentage may be, every one has the idea firmly fixed in his mind that a large number of these cases occur in the lighter cases of typhoid. Murchison[7] states that this is due to the fact that this assertion was originally made by Louis and Chomel (1834), who found the disease latent, previous to the perforation, in 10 out of 12 cases examined by them. This statement was copied into all text-books, and it was only later after long investigation that perforations were found to be more common in severe cases of typhoid. Fitz's paper supports Murchison, for of the nearly 200 cases of perforation collected by him, only 14 cases occurred in walking typhoid.

Many of our instructors have taught what has been so strongly asserted, supported as it is by autopsies, and probably backed by unreported cases which have occurred in the course of their own consulting practice, that there is a prevailing sentiment through the medical profession that perforation is specially common in ambulatory typhoid. In spite of this general belief cases of sudden death often occur in persons who have had a mild form of the disease, and whose death has doubtless resulted from the carelessness of the physicians, who neglected to remember that perforation must always be borne in mind in the treatment of typhoid fever.

A case that will serve to illustrate this is one narrated by Louis,[8] where a man with a mild case of typhoid was allowed to walk about the hospital garden each day. He was improving until the twenty-third day when perforation with the usual symptoms of collapse and peritonitis set in, and the patient died within thirty-six hours.

Two similar cases are reported to have occurred at Guy's.[9]

Many people have not known just what has been the matter with them, and have gone to the hospital only to die in a short time from perforation. Murchison[10] relates a case of this kind where the patient walked three miles to the hospital in order to find out what was the matter with himself, and died within thirty-six hours of his entrance from collapse. And Louis is said to have seen a similar case. Such cases are always a great shock to the friends, but they do not specially interest us, for the cause of death in such cases is usually apparent.

7 Murchison: Continued Fevers, 2d Ed., 1872.
8 Murchison. Continued Fevers, 2d Ed., 1872.
9 Transactions of the Medical Society of London, 1862, ii, 120.
10 Murchison, 1873, p. 75.

The same is true in those cases which occur late in the stage of convalescence. The history of the previous illness, together with the sudden onset of severe symptoms referable to the abdomen, leave little doubt as to the true cause of death.

The case of Tweedie[11] is in point. Here the patient had had an ordinary case of typhoid, and was up and about, apparently convalescent, and had been allowed to leave the house. The stools were well formed, and perfectly natural. Suddenly, symptoms of perforation occurred, and the patient quickly died.

Another similar case is recorded by Murchison. Here the patient, a laborer, had been convalescent for two weeks, and had returned to his work. One day while working he was suddenly attacked, and died in a few hours. The intestine showed typhoid ulcers nearly cicatrized, one of which had perforated and caused the fatal peritonitis.

In spite of their rarity, cases do occur when the typhoid gives no signs, or such obscure signs that they are overlooked, and treatment meant to meet certain more manifest symptoms is inaugurated, which may work most disastrously upon the typhoid lesions.

Bennett[12] reports a case of this kind where a man who was supposed to have cardiac disease with dropsy was purged. He was allowed a liberal diet, as he had an extremely good appetite. After a fortnight the bowels became loose for a couple of days, then there was complaint of general distress with some abdominal tenderness, which was taken for peritonitis from inflammation of the kidneys. Sudden death took place the next day from perforation of the ileum.

Sevestre[13] reports a case where there had been absolutely no symptoms till the sudden advent of perforation symptoms, and the patient died four days later.

A very interesting case is reported from the Hants County Insane Asylum,[14] and one where the charge of neglect might give considerable trouble to the authorities. The patient, a woman, was confined in the aslyum for mild mania and delusions, and having some dementia. She was up and about the wards, and was not considered sick until two days before her death. Till then made absolutely no complaint to the nurses.

July 17th she refused her breakfast, and complained of abdominal pain. By night she showed signs of peritonitis, and died the next day at noon. At the autopsy the ileum and large intestine were found to have numerous and undoubted typhoid ulcers, and one of the former had perforated.

Any one who has had experience with the difficulties of diagnosis in light cases of typhoid will readily see how much, on account of her

11 Recorded by Murchison.
12 Trans. Path. Soc. Lon., 1883 [Fitz].
13 Bull. Soc. Anat., 1871.
14 Lancet, October, 1889.

mental condition, the difficulties would have been increased had she made complaint, as she did not.

A case reported by Kleinwachter[15] shows how a really secondary matter can absorb the whole attention. A patient entered the hospital with an abortion well under way, and signs of peritonitis already present. A four months' fœtus was delivered without any difficulty, but in spite of all treatment the patient died the next day. The general course of the case led the physicians to think of induced abortion, and they were much surprised to find at the autopsy numerous typhoid ulcers, and a perforation from which the peritonitis had started. The abortion had started as secondary to the disease, or been induced at the time of the perforation.

November 21, 1891, I was called by a member of the Board of Health to investigate the cause of death in the case of Mrs. K., who had died suddenly, the preceding night. She was taken sick about five weeks before. The first physician who attended Mrs. K., pronounced the disease typhoid fever. A second medical attendant doubted this diagnosis. The fever was of very mild type. Her physician had not seen her for ten days before her death and refused to sign the certificate for burial. Mrs. K. had for several days been about the house and in the street.

In the night of November 20th, she was seized with extreme pain in the abdomen and great prostration, and died three hours later. Although no autopsy was made, there can be no doubt that this patient's death was caused by intestinal perforation.

Murchison[16] gives some cases where sudden symptoms have followed exposure to foul air of vaults, etc., and as some of them have resulted in sudden death with symptoms which might have been attributed to poison, they are of value here.

In August, 1829, twenty out of twenty-two boys who were attending the same boarding-school were seized within three hours with fever, vomiting, purging and excessive prostration. One boy, three years old, had been attacked two days before, and had died comatose in twenty-three hours. Another, five years old, had died in twenty-five hours after being attacked. It was found on investigation that a choked-up drain had been opened two days before the first case of illness, and the contents spread on the boy's play-ground. At the autopsy the Peyer's patches and solitary glands were enlarged like "condylomatous elevations," and in one case the mucous membrane was slightly ulcerated. The mesenteric glands were enlarged and congested.

A little girl of nine had been playing over the grating of a choked-up cesspool, from whence such foul smells came that sometimes the

15 Wiener Med. Presse, 1880, xxi, 337.
16 Murchison, p. 472.

horses had to be removed from the stable. She was shortly after attacked with febrile symptoms, vomiting, purging, and intense headache followed by acute delirium. She died forty-seven hours after the commencement of the attack. After death the characteristic lesions of early stage of enteric fever (typhoid) were found in the intestines.

Ulcerations in the stomach and upper intestine may give but little trouble, so much so that patients have no idea that anything serious is the matter, and think that they are only run down.

A case bearing on this point has been presented by Harman.[17] A boy of ten years was playing in Central Park, New York, when he stumbled and rolled down the hill on which he was. Half an hour later he was brought to the hospital. He was slightly dazed, his temperature was 101.4°, and his pulse 110, the abdomen was slightly tympanitic and tender on pressure. Four hours later he began to get pale, the pulse quickly became imperceptible, the tympany and tenderness increased, the respiration became weak and shallow, and vomiting set in, and the patient died within three hours after the onset of the collapse.

The autopsy disclosed an ulcer of the duodenum ten inches from the pyloric opening, which had perforated, and the peritoneal cavity was full of intestinal contents.

There had been no hæmorrhage. No other ulcers were to be found. Investigation of his parents showed that the boy had made no complaint, and had no symptoms referable to the gastro-intestinal tract.

A class of cases will next present themselves for attention where there is usually sudden pain in the plevis followed by severe collapse, blanching and general appearance of internal hæmorrhage. These cases have been recognized as a source of danger for a long time, but their frequency has been understood only since the advent of abdominal and antiseptic surgery.

Since 1872 there has been a great mass of literature on the subject of ectopic gestation, yet but little of it is of value to us at the present time except that anything that will throw light upon the diagnosis of obscure pelvic symptoms of course aids us in establishing our opinion as to the cause of death. But the question of abdominal operation *vs.* electricity, etc., which have occupied so much space have no interest for us except as clinicians. Therefore we are obliged for the purpose of this paper to throw out the great mass of brilliant operations which have been accumulating in the last few years. The number of cases of ectopic gestation which are now seen and recognized make it probable that in the past there must have likewise been a great many. But the fact that there are so few lithopædia to be found in museums,[18]

17 Medical News, August 1, 1891.

18 Tabs, quoted by Cushing, Boston Medical and Surgical Journal 1891, No. 2.

etc., makes it probable that only a comparatively few cases pass to full term, and that from the small number of autopsies to be found only a small per cent. die of either hæmorrhage or shock. In by far the greatest number of fatal cases death seems to have come from exhaustion, or from peritonitis, and follows some time after the first attack. Even in those cases that Barnes calls "cataclysmic," the patient usually survives long enough to allow of medical consultation.

A case reported by Dr. Trush gives a very fair idea of the usual course of an extra-uterine pregnancy. Dr. Trush's[19] patient was attending to her ordinary household duties when she was suddenly seized with excruciating pain in the lower part of the abdomen, and almost immediately everything turned dark. When the syncope disappeared she vomited freely, and an intense sickening pain in the abdomen continued. This was the attack, and gradually, after a long tedious convalescence the patient recovered, an invalid.

In spite of the fact that death so sudden that it does not allow of diagnosis is extremely rare, yet enough cases do occur to make it necessary that the examiner should have the subject of extra-uterine pregnancy in his mind in cases where the history in any way points to the pelvic organs.

Dr. Draper[20] has reported a case where an unmarried girl of eighteen was brought to the City Hospital in a state bordering on collapse. She was greatly blanched, and complained of severe pain starting in the pelvis and extending down the thighs and to the back. The hypogastric region was extremely sensitive to palpitation. In spite of all stimulation the patient died five hours after her admission to the hospital.

The clinical data were insufficient to establish a diagnosis, and as irritant poison and criminal procedure were thought of, the case became one for medico-legal examination. The abdominal cavity was found filled with three quarts of clotted blood. The left tube was distended at its outer end to the size and shape of a small olive, and in this distended portion was a rent, from whence the ovum had escaped, and the fatal hæmorrhage had occurred. The gestation was probably in its second month.

A very similar case is recorded by Jordan,[21] of Buda-Pesth. A mill-girl soon after beginning her day's work fell to the floor complaining of severe pain in her abdomen. She quickly became unconscious, and remained so until she died. At the hospital she was unconscious, very much blanched and lay slightly turned to the right side. The right leg was perfectly quiet as if paralyzed. The left leg was drawn up flexed on the body. The patient moaned most of the

19 Trans. Obs. Soc. N. Y., 1886, p. 1283.
20 Boston Med. and Surg. Journal, January 8, 1891.
21 Allg. Cent. Zeit., November 14, 1891.

time, and any attempts to examine the abdomen caused increased moaning, when the left leg was moved.

Physical examination showed the organs of the body normal excepting the presence of œdema in the lungs was noted. In the pelvis a tumor was felt upon the right side. The breasts were slightly enlarged, and later it was learned from friends that there had been no menstruation for two months. After some delay diagnosis of extra-uterine pregnancy was made with rupture on the right side. As preparations were being made for operation the patient suddenly died. A medico-legal examination followed. The left tube was found ruptured, and a solid clot weighing about 1,000 grammes was found on the right side of the pelvis.

(The writer draws the conclusion from this case that the patient lay instinctively upon the unaffected side just as a person with acute pleurisy. The blood consequently gravitated to the right side making the tumor appear upon that side. Therefore Jordan thinks that the position of lying should always be taken into consideration in establishing a diagnosis as to which tube is affected.)

The following case of Zweifel,[22] of Leipzig, though operated upon, illustrates very well the suddenness of the attack, and the difficulties in the way of making a diagnosis. The patient was taken with very sudden and severe symptoms of abdominal pain while she was in the garden. She fell to the ground, and from there was removed to the hospital. She had recently had her third child, and there had been no signs of pregnancy present. Colostrum was found in her breast, and a pelvic tumor was felt on vaginal examination. Laparotomy was performed, and a ruptured tube was found, but the patient only lived a short time after the operation.

In June, 1890, I was called to Meredith, N. H., to operate upon a patient who was suffering from hæmorrhage into the abdominal cavity. I reached the patient about two o'clock in the morning five hours after the summons, when I found a woman almost exsanguinated with sighing respiration, and an almost imperceptible pulse. The history of the case is as follows:

This woman had been apparently well. Had missed one menstrual period, and a day or two before had commenced to menstruate. She was left in the morning alone in the house. When her husband returned at 5 o'clock in the afternoon, he found her lying upon the floor entirely unconscious. On examination an ill-defined solid mass was found in the abdominal cavity. There could be no doubt that this was a case of ruptured ectopic pregnancy. The patient had so much the appearance of being *in articulo mortis* that I regarded any surgical interference as absolutely hopeless. The patient, however, went on to a complete recovery, except that there has since remained

22 Zweifel: Archiv. f. Gynæ., 1891.

in the pelvis a distinct solid mass. Although this patient did not die, and the diagnosis was not verified, either by operation or post-mortem examination, still there can be no question as to its correctness. When she fell to the floor, had she died instead of making a narrow escape, and had been found in this condition, the medical examiner who would have been called in, would probably never have suspected the real cause of death, and in no other way could this have been determined than by a post-mortem examination.

A case reported by Fœrster[23] is very suggestive, as similar cases could easily occur among a class of patients where foul play might be suspected. The woman was twenty-nine years old, and had one child a year before. Menstruation was regular until one month before, when the duration was six instead of three days, but was very scanty throughout. The patient stated that she did not believe herself pregnant. With the approaching menstrual period she had had greatly increased sexual desire, which her husband had been gratifying to excess. During this procedure the patient felt a sharp pain in her right side, which she supposed to be due to indigestion, and various household remedies were used. Three hours later the physician was called. The patient was then in complete collapse, with pulse hardly to be felt, blanched, and with cold, clammy prespiration. The lower part of the abdomen was sensitive. The husband denied cohabitation for some months past, and refused an operation asked for on the diagnosis of extra-uterine pregnancy. The patient died in a few hours. After death two litres of blood were found in the abdominal cavity. The right tube was distended, and a rent was present large enough to allow of the escape of the head of the fœtus. A right corpus luteum was present.

DISCUSSION.

Dr. Abbott,—I can only speak of two cases of perforation after typhoid fever. Both occurred in the practice of my preceptor about 1860. Autopsies were obtained so that the diagnosis was confirmed. One was in a woman 30 years old, the other in a man about the same age. The man was intemperate, had been sick some time, not an ambulant case. The woman was an ambulant case, and had been suffering from typhoid fever in mild form. She kept about the house and was washing. I think she had lifted a tub of water. Suddenly she was taken with a severe pain, and soon after with swelling and tympanites and died in the course of forty-eight hours. The autopsy showed perforation in both cases.

It seems to me the percentage of 6% as given is high, from what I have known of the practice of physicians in my own neighborhood. I never had a case in my own practice, and I do not remember

23 Fœrster; Jour. Amer. Association, 1890, p. 1204

any in the town where I live. I should think one or two per cent. would come nearer the facts in ordinary country practice. I do not know how it is in hospitals.

Dr. Adams,—I can recall only one case of sudden death from perforation in typhoid fever, and even that I have always regarded as a doubtful case. There was no autopsy, and it took place some two months after the fever had apparently ceased. The woman however had never recovered. She was a maiden lady of about forty. She was in bed about six weeks with a mild type of fever which I regarded as typhoid. She then began to convalesce and was able to be up and about, but still she got well. She continued very feeble and languid, and there was some difficulty about establishing a proper action of the bowels. She then got so well that she went out frequently, and one day went to town on the cars. She came home and was suddenly seized with very violent pain and collapse and died in two or three hours. I was not at home at this time, but upon my return I heard of the circumstances connected with her death. I had not seen her for at least two months. That is the only case I can remember where I suspected perforation of the bowel from a typhoid ulcer, but the length of time after the fever has always left it in doubt in my mind.

Dr. Stone,—There are two more cases I found in looking up the literature. One case was that of a big burly dragoon in India who was in the Hospital on account of eczema of the leg, which was yielding to treatment. The temperature had been taken several times and was never above the normal, yet after being in the hospital some sixteen days, and showing absolutely no symptoms, he one morning vomited and fell down and died, and at the autopsy it was found that there was a large ulcer two or three inches in length, and perhaps a third of the width of the intestine on the front side had ulcerated through, and gangrenous ulcers were found up and down the full course of the intestine.

The other case was that of a negro who had been working on a plantation. He came down to the village, had given no complaint during the last four or five days while he had been at work. After being at the village a short time he began to vomit, have extreme pain in the belly, and within three or four hours he died. At the autopsy there was found a twist of the whole of the transverse colon, and death probably occurred from the shock. No cause was known why that twist should have taken place.

Dr. Johnson—This is a very timely and instructive paper, calling attention to the fact that there are fatal lesions in the abdomen, which give no indication of their presence, so that, although the medical examiner can give no history of any abdominal trouble, he should carefully examine the abdomen by palpation as well as make inquiries of friends as to the antecedent symptoms or their absence. I remem-

ber a case which illustrates how there may be a grave lesion in the abdomen without suffering. A patient of mine was pregnant, and in the first months of pregnancy suffered greatly from the vomiting of pregnancy, and after the first two or three months the vomiting ceased. During the early part of the ninth month the vomiting returned. Having seen her in the early part of the pregnancy the vomiting was regarded as due to the condition of the uterus. Ordinary remedies did not arrest it, and artificial delivery was advised. It was induced and went on kindly, and about twenty-four hours afterwards she commenced to vomit again. After vomiting several times violently she threw up a gall-stone about the size of a nutmeg, and altogether too large to pass by the duct and which must have escaped by some process of ulceration into the duodenum, or possibly into the stomach. She died. The most interesting point in connection with it was the interpretation that we put upon the cause. We could get no autopsy. We could obtain no history of having suffered from gall-stone. She had never had the characteristic biliary colic. This process of ulceration had gone on without any symptoms, showing how desirable it is to examine the abdomen.

Another point occurs to me with reference to sudden death from conditions of the abdomen. We get impactions and they give little trouble because it has been stated that the person perhaps neglected the bowels. After a time there comes a tremendous seizure of colic. The person may die of shock from colic and no evidence of any organic trouble is found. It may be a person advanced in years or debilitated by fatigue or of poor nutrition and I can conceive that the shock in such a case might produce death. I think I have seen death produced from conditions of the stomach where a person was in advanced years and pressure upward from the stomach overpowered an already somewhat enfeebled heart.

Dr. Paddock—I think that perforation of the bowel very often occasions sudden death. A case I had in October of a coachman will represent a certain class of cases. He was a man of sixty. He had been able to attend to his duties. About two days before his death he sent for his physician, on account of pain in the bowels. He was laid up one day, and on the next day went to work again. On the third day he had a very constipated movement of the bowels, and while straining at stool he felt something give way in the bowels, suffered most excruciating pain, and died after four hours. At the autopsy there were found three large ulcerations in the ileum. They had ulcerated through the mucous membrane and through the muscular coat, and each one had opened into the abdominal cavity, the cavity being full of faecal matter and gas. These ulcerations were old. They had ulcerated through the bowels, caused extensive adhesions of the surrounding intestines and the abdominal wall and must have

been in existence for weeks or months, and yet this man had been able to attend to his duties. He was not a very strong man and had not been feeling very well for a year, still he had been able to drive a team and attend to his work until within three days of his death.

There were two cases of ectopic gestation in my practice, one where death occurred very suddenly about the third month, from rupture of the blood vessels in the placenta covering the tube, and the other where the sac was ruptured. The first case, was that of a woman about three months' pregnant, who one day on getting out of bed in the morning vomited and immediately became pale and cold and went into a collapse. She died in about three hours. At the autopsy the abdomen was found full of blood and with the sac in the left tube perfectly formed, and in it was a fluid. It was about as large as a small orange, with an imperfectly formed foetus. The cause of death was the rupture of some capillary blood vessels in the placenta covering the sac on the outside.

The other case was that of a woman who died suddenly during menstruation. She was taken with great pain and collapse and lived only twenty-four hours. At the autopsy the sac, which was not larger than a butter-nut, had ruptured, and the contents were in the abdominal cavity with a large quantity of serum.

It seems to me in all these cases of sudden death unless there are some very prominent symptoms that indicate that the death comes from natural causes, it is well to make an autopsy. Most of them are attended with vomiting and distress and collapse, that is apt to follow the ingestion of poisons.

I would like to know whether Dr. Irish recommends early laparotomy in connection with ectopic gestation.

Dr. Irish,—I do. There are certain points about that, about which I might speak. In the case I reported I did not operate because, with a pulse very much higher than 120, or with a pulse that you cannot count, those patients cannot tolerate the anæsthetic in an operation of any length in the abdominal cavity. We read the histories of patients practically *in articulo mortis* having an operation done in the abdominal cavity, and withstanding the additional shock of that operation. In my life I have tried that in several instances and those patients have always died, and I have rather established it as a rule in my own practice with a pulse much rising 120, never to undertake anything in the abdominal cavity, except it be something that can be done in one or two minutes. Any more extended operation there, will be fatal, and judging from my own experience, is always fatal. In these very desperate cases of hæmorrhage with an imperceptible pulse at the wrist, most of them will die from the anæsthetic, practically before you have got into the abdominal cavity at all, and I really do not advise attempting it in those very extreme cases.

I have only one thing to add to the discussion. There is no doubt that deaths from the rupture of extrauterine pregnancy are pretty frequent, and still taking the work done by myself, and two cases reported here, there will not be found in literature I think a half dozen additional cases reported, of death from that cause, where the autopsies show it, still it is undoubtedly not a very infrequent cause of death. If we were to depend upon the literature of the subject we should suppose it was one of the rarest causes because there is a dearth of reported cases.

Dr. Paddock,—I would like to speak of a colored woman who came under my care, who had an abdominal tumor and was supposed to be pregnant, but the child had never been born. One day I was called to see her and found projecting from the anus a femur of a foetus, and in the course of three weeks I myself removed I think seventeen bones which had come away from the abdominal cavity through the rectum. That woman lived about six months after the bones were removed, the pieces of the skull came away and the jaw bones and all of the long bones. She finally died of exhaustion and septicaemia. She carried that tumor four or five years before the bones finally ulcerated through into the rectum and were passed.

SUDDEN DEATH FROM AFFECTIONS OF THE NERVOUS SYSTEM.[1]

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AN inquiry into the causes arising within the nervous system which may give rise to sudden death is by no means easy. Registration reports and vital statistics seldom separate such cases from the total number of deaths attributable to any given cause, and a study of clinical records with autopsies would require an enormous expenditure of time before a sufficent amount of evidence could be accumulated. I can offer, therefore, only a few *a priori* considerations as to the possible occurrence of sudden death in affections of the nervous system, basing my statements rather upon the probable events in any given disease than upon statistics. In such a study I exclude traumatic affections of the nervous system, and poisons which cause death by their action upon the nervous system, whether they be taken into the system from without, as in the case of opium, or be generated within as in the case of the poison of uræmia.

Before begining the inquiry, however, a word of definition seems necessary. I shall limit the consideration to cases of death occurring within an hour from the onset of symptons; only in such cases will I speak of sudden death, using the term speedy death for cases where death occurs within twenty-four hours.

I shall consider sudden death as occurring from affections of the peripheral nerves, the spinal cord, the brain, and in the neuroses.

I. PERIPHERAL NERVES.

Sudden death is not uncommon where there is inflammation of the vagus. It is due undoubtedly to paralysis of the heart. Such a vagus neuritis is not uncommon after the acute infectious diseases, especially diphtheria, and to it are now generally attributed the sudden deaths which are so common after these affections. In multiple neuritis arising from other causes such a sudden cardiac paralysis rarely, if ever, occurs. When death ensues as a result of vagus neuritis, as is not uncommon, it is of gradual onset, and is attended by various respiratory

1 Read before the Massachusetts Medico-Legal Society, February 3, 1892.

and circulatory symptons. It would seem, therefore, that some other factor beside the vagus neuritis, is requisite; and this factor is probably the degeneration of the cardiac muscle, which is also not infrequent in such infectious diseases. Only in the last instance can these cases be attributed to affections of the nervous system, for the acute infectious disease has a large share in their causation. They may therefore be excluded from this inquiry, the more in that they seldom have any medico-legal interest.

II. SPINAL CORD.

Lesions of the spinal cord rarely, if ever, give rise to sudden death. Lesions of the medulla will be considered with lesions of the brain. It is, of course, obvious that lesions high up in the cord, close to the medulla, may act very like lesions of the medulla itself, but such lesions need no separate consideration.

Spinal meningeal hæmorrhage. — Ollivier long ago contended that meningeal hæmorrage, unlike cerebral hæmorrhage, could not produce death by a "stroke." Leyden [2] later contested this statement, and Gowers [3] thinks it very common for death to ensue in a few hours. Death, however, seems to be speedy rather than sudden; it usually takes place, at the soonest, after a period of three to six hours, with symptoms of spinal pain, paraplegia, etc. In a part, at least, of the fatal cases, especially those where death has come on the quickest, the hæmorrhage was high up, involving the medulla, or there was co-existing cerebral hæmorrhage, or the patient died of shock.

Spinal hæmorrhage. Hæmato-myelia. — This effection is extremely rare, and it seems to cause death rather less speedily than meningeal hæmorrhage, unless the lesion be high up. The shortest time in which Leyden [4] found that death occurred was thirteen hours.

Acute hæmorrhagic myelitis. — Death in this affection is distinctly of slower onset than in hæmorrhage. Strümpell [5] thinks it not impossible that, in some cases where children die in a short time with fever, convulsions, etc., there may be an acute polio-myelitis; but that is purely an hypothesis. Unless the myelitis involve the upper part of the cord death seldom occurs until a week or more has elapsed.

III. BRAIN.

Meningitis. — Even in the fulminating forms of cerebro-spinal meningitis, and the rapid cases of tubercular meningitis and meningitis from ear disease, we rarely meet with cases of sudden death. Stillé [6] finds the shortest duration of any case of cerebro-spinal men-

2 Leyden: Klinik der Rückenmarkskrankheiten, I, 382.
3 Gowers: Diseases of the Nervous System, I, 207.
4 Leyden: Op. cit. II, 80.
5 Strümpell: Text book of Medicine, p. 632.
6 Stillé: System of Medicine (Pepper), I, 819.

ingitis (Gordon's) to be five hours. Meningitis of tubercular origin or from middle ear disease may come on suddenly, with paralysis, etc., as if from a "strcke," and the patient may rapidly become comatose, and die; but in such cases the period of coma is more or less protracted and the patient usually lives several hours or even days.

Meningeal hæmorrhage. — Hæmorrhage into the meninges of the brain, whether it be dural or pial, usually does not give rise to sudden death. In fourteen cases of surface hæmorrhage Dana [7] found the limits within which death occurred to be from one to eight days. If, however, the hæmorrhage be due to a rupture of a large vessel at the base (notably the basilar artery, the favorite seat of aneurisms), the resultant pressure upon the medulla will cause sudden death, sometimes within two or three minutes.

Cerebral hæmorrhage. — This may be regarded as the chief cause of sudden death in affections of the nervous system. Sudden death is, of course, most common in hæmorrhages into the medulla, the pons, or the cerebellum; most sudden, of course, in hæmorrhage into the medulla. In addition to these distinct focal hæmorrhages, which may from their proximity to the vital centres in the medulla, give rise to sudden death, hæmorrhages higher up may rupture into the ventricles. Dana found that out of thirty-two cerebral hæmorrhages, twenty-six ruptured into the ventricles; Charcot and Bouchard [8] found this only in eighteen out of seventy-seven cases. In only a small proportion of these ruptures into the ventricle is death sudden, although it is usually speedy. Dana gives the average duration of life as from one to three days.

Cerebral softening. — Cerebral softening is, as a rule, less dangerous to life than cerebral hæmorrhage, and much less frequently can it give rise to sudden death. Hunt [9] notes a case where embolism of the only large artery that supplied the brain did not cause death for hours. As with hæmorrhage, sudden death occurs chiefly from thrombosis in the arterial supply of the cerebellum, pons, and medulla, and thrombosis of these arteries is far less common than hæmorrhage from them. Out of fifty fatal hæmorrhages, Dana found the average duration of life to be a week, if the hæmorrhage were not ventricular, but with softening the duration was from one to ten weeks.

Abscess. — Cerebral abscess need be mentioned only to note the relatively rare occurrence of rupture of its contents into the ventricle, which may give rise to sudden or speedy death, as in hæmorrahge.

Tumor. — It is not unusual in cases of cerebral tumor to see coma set in, without any apparent cause, and death to ensue in a comparatively short time, twelve to forty-eight hours. The cause of such a

7 Dana: New York Medical Record, 25 July, 1891.
8 Wernicke: Lehrbuch d. Gehirnkrankheiten, ii, 47.
9 Hunt: Birmingham Medical Review, April, 1880.

condition is uncertain; but it is very likely due to vascular changes. Only in the rarest cases may some vascular change in a new growth close to the vital centres lead to sudden death.

Encephalitis. — The few cases of acute hæmorrhagic inflammation of the medulla, to which Wernicke has given the name of acute polioencephalitis, are the form of encephalitis in which we should most naturally look for sudden death, but even here death has occurred only after an illness of several days.

Sclerosis. — In disseminated sclerosis and in general paralysis of the insane, pseudo-apoplectic seizures and convulsions are not infrequent, and they may bring about death. Sudden death, however, is in all probabilty extremely rare from such a cause.

Insanity. — Sudden death is occasionally seen in cases of acute mania, but it is due to conditions outside of the nervous system, and need not be considered here.

IV. NEUROSES.

Convulsions. — Beside accidental causes, such as asphyxia and injury, death may occur suddenly, in very rare instances, in the epileptic fit. The precise cause is unknown, but there is probably some profound vascular disturbanee. It is not, however, solely, in the true epileptic fit that sudden death may occur, but also in the fit due to gross cerebral lesions, tumor, general paralysis, or multiple sclerosis; and Raynaud [10] reports a case of death from spasm of the larynx and pharynx in what was thought to be an hysterical convulsion.

Exophthalmic goitre. — In this affection death is occasionally sudden, and the cause is obscure. Recent hypotheses as to the nature of this disorder tend, however to remove it entirely from the diseases of the nervous system; and, considering the profound cardiac disturbance, it is most probable that sudden death is due to some affection of the heart.

Shock. — Finally, we must speak of those cases of sudden death from emotional disturbance, from slight injury, etc., which are usually ascribed to "shock." The nature of the process is far from understood, but it is usually ascribed to inhibition of the vagus centre from cortical or reflex stimulation, and in some unkown way the nervous system plays a part.

From this very imperfect review we see, therefore, that sudden death may ensue from certain disturbances of the nervous system, — vagus neuritis, hæmorrhage, convulsions and shock. Excluding the first of these, for reasons already given, we find that the chief and by far the most frequent cause is hæmorrhage, and that, when hæmorrhage into the central nervous system causes sudden death, its seat is almost always in the brain, involving the important centres in the

10 Gowers: Epilepsy, p. 161.

brain stem. Speedy death may arise from various other conditions—spinal hæmorrhage, softening, new growths or sclerotic processes.

In the ultimate analysis, therefore, we find that sudden death in so-called affections of the nervous system, is to be referred not to changes in the nervous system itself, but to changes in the vascular system — the system primarily responsible for the majority of cases of sudden death.

At the begining of this century apparently many of the cases of sudden death were attributed to apoplexy. As a matter of fact the nervous system is apparently responsible for only a few of the cases. Such few statistics as I have been able to gather are of old date, but they may be of interest.

Granville,[11] found in the English reports from 1847 to 1851, 17,478 cases of sudden death, out of a total of 2,028,145, nine-tenths of one per cent. or one in one hundred and sixteen. Francis[12] out of 733 deaths of persons over ten in the Manchester work-house found nineteen, or one in 38.57 which were sudden, within a quarter of an hour. Of these three died of apoplexy, and two of epilepsy. Devergie,[13] in forty cases of sudden death at the Paris morgue found one from hæmorrhage into the pons, three from meningeal hæmorrhage, two from "serous apoplexy with pulmonary congestion," and three from "cerebro-spinal congestion. Only four of these can certainly be assigned to the nervous system. Out of seventy-four cases of apoplexy collected by Dana only one involved the pons and three the cerebellum, and sudden death was not noted.

It is probable, from these figures, that not one death in a hundred is sudden, and only about one-tenth of these are to be attributed to affections of the nervous system.

DISCUSSION.

Dr. Bronson.—In speaking of hæmorrhage within the medulla where the death is not sudden, what induces death? Is it an inflammatory process that sets in, or subsequent hæmorrhage which induces death?

Dr. Knapp.—I think any case of hæmorrhage into the medulla would produce sudden death from paralysis of the respiratory centres unless there was a very small hæmorrhage. A small hæmorrhage might lead either to partial hemiplegia or to paralysis of some of the cranial nerves, and might not necessarily be fatal, but a hæmorrhage into the pons or medulla giving rise to hemiplegia might subsequently prove fatal from exhaustion, not necessarily from inflammatory action.

11 Granville: Sudden Death, London, 1854.
12 Francis: Guy's Hospital Reports, Second Series, iii, 76, 1845.
13 Devergie: Bull. de l'Acad. de Med., ii, 824, 1837-38.

Dr. Hartwell.—We are under great obligation to Dr. Knapp for his very interesting and tersely-put paper. It gives us all the essential points in less space than any that we could find by long investigation, and it illustrates a point that perhaps not all of us know, that most of these cases of sudden death are from the heart,—as I believe he puts it 5%, 1% of those occurring within an hour are of the nervous system. Dr. Janeway states that cases that are sudden without any appreciable time elapsing, are due to the heart and not to the nerve centres.

A point that he mentioned brought to my mind a case which occurred a week ago in my practice, illustrating the length of time that can elapse,—he stated I think that several months might elapse before death ensues from cerebral abscess. The case illustrates how few symptoms there may be. A negro, a strong healthy man of 42 years six feet in height, weighing 180 to 190 pounds, an athlete, had been at work as usual up to the time he was found. The day before the last day of his work he had complained of slight fatigue. That was the only symptom. He lived alone and was found in a comatose condition. I saw him in consultation and to the best of our knowledge we pronounced it apoplexy. There was slight paralysis of the right leg. He died in twenty-four hours. At the autopsy we found cerebral abscess on the left side of the brain above the left ventricle about as large as a peanut. It was filled with a soft creamy pus. No injury, no evidence of external injury. The brain around it was in a normal condition except a zone of red softening. Death was not sudden but speedy. The abscess was well defined. The walls were not hard, so that there was a distinct line of demarcation between the pus and the surrounding cerebral substance.

Dr. Johnson.—I would like to ask how Dr. Knapp would construe fulminating forms of diabetes. I remember one case which died inside of twenty-four hours. The only other case was a patient I had under observation for 18 months, seemed to be doing pretty well but went into a state of coma and lived three or four days. The coma continued until death. In the first instance, the young man, a draftsman in a car factory, had been at his work, came home and complained of feeling languid. I could find nothing to explain his condition, and asked for some of his water and found it contained sugar in large quantities. I asked for a consultation. When we revisited the case he was sinking and in the afternoon died. That was apparently diabetic coma. Perhaps the doctor can give us the latest theories by which the coma of diabetes destroys life.

Dr. Knapp.—I did not consider that, as I said at the beginning of my paper. I suppose the diabetic coma destroys life by the development of some poison. That would be classed with the cases of suddenly developing coma from Bright's disease, in all probability

due to the action of some poison upon the nervous system. Our knowledge as to the precise pathology of diabetes is very indefinite as yet, and I excluded that class of cases from consideration.

In reference to what Dr. Hartwell said in regard to cerebral abscess, I omitted to mention that with an abscess as with a tumor, the patient may suddenly become comatose. I saw a case with Dr. J.O.Green which has been reported. The woman had had mania, had been at Danvers and came back still with a certain amount of headache. The coma came on gradually and she lived twenty-four to thirty-six hours, and there was an abscess as large or larger than an English walnut, involving the whole temporal lobe and extending into the basal ganglia. I do not know that you get absolutely sudden death in the case of abscess. It would be more like the cases of tumor, coma developing and death ensuing in twenty-four hours or longer, unless the abscess ruptured into the meninges or ventricles.

Dr. Hartwell.—In relation to the case I mentioned, there was no evidence of any ear disease. The man was an athlete who could put his hands on the floor and spring on his feet. It was reported that two or three months previously he fell and struck his head.

Dr. Knapp.—Such a thing I suppose might develop from a blow. The last case of cerebral abscess I know of was a patient who had been trephined a year and a half before; the operation was done under thorough antiseptic precautions, went on perfectly well without rise of temperature, and everything healed. He improved for a time, then became more and more demented, had various convulsions and at the autopsy, beneath the trephine opening which was covered over by skin and membrane perfectly, was an abscess.

I should be a little suspicious of a simple blow upon the head without any injury to the skin or bone beneath producing an abscess, but it may of course from a fracture, or from a cut upon the head.

THE COY MURDER.

MEDICAL EXAMINER FRANK K. PADDOCK OF PITTSFIELD.

John Whalen, aged 30, a resident of Washington, Massachusetts, was last seen alive Saturday night, August 29, 1891, about nine o'clock. He was unmarried, and a native of the adjoining town of Becket, where his family still live. He was employed by the Boston & Albany R. R. corporation as a track hand on the Washington section. He boarded with a fellow employe named William Coy, who, with his wife, lived about one mile from the Washington Station, in an unfrequented and lonely location.

Saturday evening, August 29th, both Whalen and Coy alighted from the train, which arrived at Washington, from the east, about 8 o'clock. Whalen was intoxicated and remained about the station for an hour or more and then staggered away toward his boarding place, while Coy was seen to board the train, as it moved away and went to Pittsfield. Whalen was never seen again alive. It appears that Whalen had stated his intention of going west to find work, and on this Saturday, he had been to Lee and drawn several hundred dollars from the Bank. It is supposed that Coy was with him; at any rate, he knew that Whalen had considerable money.

The following morning Coy inquired of several people if they had seen Whalen, stating that he had disappeared from his house and taken his trunk with him and he thought he had gone west. For six weeks Whalen's whereabouts was a mystery. During this time, Coy did not work on the railroad. He was known to have more money than usual, and he also carried Whalen's watch, which he said Whalen had presented to him, and said also, that Whalen had made him a present of money.

A few days after the disappearance of Whalen, Coy and his wife left their house, Mrs. Coy explaining to some of the neighbors that she could not live there, it was too lonesome. This explanation, however, did not satisfy the few people, who lived in the sparsely inhabited neighborhood and it was suspected that Coy had recourse to foul play, in order to get Whalen's money, but nothing was positively known regarding the matter, until October 13th, six weeks after he had disappeared so suddenly.

On the morning of that day, October 13, a farmer, living in the neighborhood, accompanied by his dog, went in search of some stray cattle. While passing through the woods on the hill side, about fifty rods from Coy's house, he noticed his dog digging in a shallow hollow. He went to the place and discovered a mound of fresh earth covered with leaves. Upon displacing some of the dirt with his boot, he came upon the end of a trouser suspender. This was sufficient to arouse in his mind the suspicion, that he had found the grave of Whalen.

The selectmen, officers, and the medical examiner were notified. Coy was arrested on suspicion and placed in the Pittsfield jail. The same afternoon the grave was opened and Whalen's body was found covered by about a foot of earth. The body was in a fair state of preservation, and was naked. The epidermis was loose and peeled at the slightest touch. A flannel undershirt and a pair of trousers were spread over the body, underneath the earth. The left side of the skull was fractured. A piece of the bone 2 3-4 inches in length by one in width was completely separated from the skull, having been driven through the dura into the brain. This fracture extended in a vertical direction from the lower anterior angle of the left parietal bone directly upward. The line of fracture, in front, extended along the coronal suture. In the throat there was a gaping wound, which extended entirely across the front of the neck down to the spinal column. The lower portion of the body of the fourth cervical vertebra was split off and found lying loose at the bottom of the wound. The wound, of course, divided the trachea, both carotids and jugulars. Both legs were cut off about three inches above the knees, the bones having been sawed through.

When the body was uncovered, the amputated legs were found lying across and on top of the trunk. There were no other wounds discovered. The body was identified by a deformed left hand, the result of injury by a hay-cutter, during childhood. The brain was considerably decomposed, discolored, and shrunken to about two-thirds of its normal size. The heart was also in an advanced state of decomposition, while the lungs, liver, kidneys and intestines retained, in a considerable degree, their normal appearance and consistency. There was no blood found in the aorta, vena cava, or in any of the large blood vessels.

The cause and manner of death, judging from the condition of the body at the examination, appeared to be as follows; that the man was in a recumbent position, lying upon his right side, when he received a powerful blow from some blunt, sharp cornered, oblong weapon, upon the left side of his head. A blow with the head of an axe would be likely to produce such a wound. Following this first blow, which would certainly render the man unconscious, a second blow, with the edge of the axe, would, if made with a strong arm,

make a wound in the neck, extending into the body of the vertebrae, similar to the wound found on the body. It was therefore decided that an axe was the probable weapon employed. The death of the victim having been assured, the amputation of the legs was done for the sake of convenience in conveying the body up the hill fifty rods, and also because a smaller excavation for interment and concealment would thus be necessary.

The house vacated by Coy and his wife, after the disappearance of Whalen, six weeks previously, was examined. In the room where Whalen lodged were found evidences of a bloody encounter. On the floor were blood stains although the floor had been washed. There were spots on the headboard of the bed, and also on the wall of the room, where blood had been spattered. Large pieces had been cut out of the ticking of the straw mattress upon the bed, indicating that an effort had been made to destroy tell-tale evidence of blood stains.

The circumstantial evidence so far obtained indicated that Coy was the murderer of Whalen. The chain of facts evidently influenced Coy to a confession, which he made in writing a few days before the inquest was held, stating that he killed Whalen with an axe, in self defence during a quarrel, and being overcome by fear, when he realized the probable consequences of the deed, he buried the body secretly and tried to destroy all evidences of his death so that the truth should not be known. He stated also that his wife was not at home at the time and took no part in the altercation.

In regard to the details of this quarrel he made a number of statements, no two of which are alike in many particulars. In each account, however, he maintained that the cause of the quarrel was the fact that he discovered in Whalen's trunk, his wife's clothing packed, preparatory to her elopement with Whalen, when he took his journey west.

Coy was indicted by the grand jury for murder. His trial took place in March, occupying five and a half days. The trial was peculiarly interesting, because it was the first case tried under the new law, requiring the presence of three Justices of the Superior Court to hear the evidence in capital trials. Judges Mason, Blodgett and Hammond presided.

The case for the Commonwealth was conducted by the Attorney General and the District Attorney. The prisoner had no counsel, therefore the court appointed two lawyers to defend him, which they did in a very able manner. Judge Blodgett charged the jury. They were out two hours and brought in a verdict of murder in the first degree. The defense appealed to the Supreme Court, on exceptions. The arguments before this tribunal have not yet been made, therefore Coy has not yet received his sentence.

The Attorney General summoned three physicians to be present at the trial, hear the evidence, and testify as medical experts. The Judges were called upon to decide some rather difficult questions, during the progress of the trial, one of which was a motion of the defense to quash the imperfect indictment, which read as follows, concerning the cause of death:

"And that he the said William Coy then and there with a certain axe which he the said William Coy in both his hands then and there had and held, him the said John Whalen in and upon the head of him the said Whalen on the left temple bone thereof upon the left side of said head, then and there at Washington aforesaid feloniously, wilfully and of his malice aforethought did strike giving unto him the said Whalen then and there with the axe aforesaid by the stroke aforesaid in the manner aforesaid in and upon the head of him the said Whalen on the left temple bone of his said head upon the left side of his said head one mortal wound of the length of four inches, of the breadth of one inch and of the depth of one-half inch, of which said mortal wound the said Whalen then and there instantly died."

The indictment states, as you perceive, that the wound of the head caused instant death and no reference whatever is made to the wound in the throat. Without exception, the medical evidence tended to prove that the wound upon the head was in all probability a mortal wound but that it would not necessarily or probably cause instant death; that the murderer undoubtedly discovered this to be a fact and cut the victim's throat in order to hasten or make certain his death. The defense claimed, therefore, that the cause of death as stated in the indictment was incorrect and that the jury could not legally find the prisoner guilty of murder. A new indictment would, of course, necessitate a new trial. The Judges finally overuled the motion and the case proceeded.

The defense endeavored, as far as possible, to substantiate Coy's confession which entitled him to a verdict of murder in the second degree, or, possibly, justifiable homicide, if the jury considered the deed done in self defense. He was put on the witness stand and testified that Whalen attacked him with the axe, but he got the weapon away from him and struck him a blow in the throat with the edge of the axe, while standing face to face. The axe swung around to the left and he swung it back again, striking Whalen on the temple with the back of it, thus fracturing the skull. Coy was right-handed and a blow struck in this way, first from right to left, would necessarily have rendered it certain that the second blow must have been in the opposite direction, or from left to right. This would have brought the head of the axe in contact with the right side of Whalen's head. The wound, however, was on the left side of the head, which, of course, disproved this statement. Then too, the long axis of the wound in the

skull was perpendicular, or, in other words, was parallel with the coronal suture, whereas the narrow head of an axe driven into the side of a skull by a blow from a man standing directly in front of his victim would have made a wound whose long axis must have been nearly at right angles with the wound found in Whalen's skull. It is evident that the jury did not believe Coy's testimony to be true and brought in a just verdict.

Since the above report was written, the Supreme Court decided against the application for a new trial, and the Governor declined to pardon Coy, or commute his sentence.

He was hung at the Pittsfield House of Correction, Feb. 24, 1893.

THE IDENTIFICATION OF THE SKELETON.

In 1878 a valuable paper was contributed to the Massachusetts Medical Society, being the prize essay of that year, by Dr. Thomas Dwight, of Boston, in which the principal questions which are likely to arise in the identification of skeletons, were stated as follows:—

1. Are these bones human?
2. Do they belong to one or more individuals?
3. What is the sex?
4. What is the age?
5. How long is it since death?
6. What is the height?
7. If certain parts are wanting, can we estimate their size? If so, how?

In this paper the foregoing points are carefully discussed, and certain fallacies of previous observers are indicated. Many useful observations and tables are presented, which are worthy the attention of the Medical examiner. Such cases more frequently come to the notice of the country official, than to those whose duties are limited mainly to the cities, since the skeletons of human bodies which have lain undisturbed for varying periods of time are more commonly found in remote and sparsely inhabited districts.

The point to which Dr. Dwight gives the least attention "The time since death" is worthy of further examination and study by the Medical examiners. This question was discussed in an informal manner at the meeting of the Medico Legal Society Feb. 1, 1893, two or three points of especial interest being presented by different observers.

These were mainly, the great difference in the time required for the removal of the soft parts of the body when lying exposed on the surface of the ground at different seasons of the year, and secondly the rapidity with which certain species of insects will remove the soft parts during the warm seasons of the year.

One case was read at that meeting and two others were recalled which had been reported briefly at previous meetings. These three

cases are herewith grouped together and presented as a contribution to the subject.

The first was in the practice of Medical Examiner Winsor and is copied from his Report in the files of the Society.

View in Woburn, on swampy land south of Cambridge St., and northwest of house of J. P———, Date, Dec. 26, 1878, 9 A. M.

Male, 60 years old.

Body lay on its back in the middle of a thick growth of small trees in swampy ground. With the exception of the head and neck it was under water, or rather, ice, being frozen into the ice which covered the swamp at that season. The skull lay on ground which was a little higher than the body and was scarcely frozen down. It was bare, dry, and empty. To the frontal bone, and anterior portion of left temporal bone a little dry and half-detached scalp tissue clung on which were a few scanty grey hairs. Lower maxilla was detached. There was no trace of flesh, ligament or membrane (other than that named above) on skull or cervical vertebræ. All the slight and fragile bony processes of the skull were entire. Within its cavity were some pine needles. The ramus of the lower maxilla was quite oblique and the alveolar processes of both jaws were much absorbed. As to the *teeth*, in upper jaw there were the incisors, canines and first bicuspids together with first right molar. In lower jaw right lateral incisors second and third right molars, both canines, both left bicuspids first and second left molars. The entire trunk with the limbs was bedded in ice and was removed in a mass by chopping about it and prying it out. It was then removed to an undertaker's shop in Woburn and then placed in charge of an officer to slowly thaw out.

Two pocket knives lay at the foot of a small pine tree on dry ground close to the skull. Both were closed, one had six blades with a "mother-of-pearl" handle and brass ends, also a plate for name, but none was inscribed there. The other had a single blade and a handle of brown wood.

The body was found about noon Dec. 25, by men who were hunting and was reported by them to an officer at 9 P. M. and to me at 11 P. M.

My opinion at the time was that the body had lain in the swamp for many months of warm weather before frost set in, and that the soft parts had been stripped from the head and neck by insects which had also emptied the skull of its contents. If rodents or birds had aided them the fragile bony processes would have been broken.

On the following day Dec. 27, the view was continued at the undertakers. That evening ice had all thawed and the remains were fully

exposed. No flesh remained excepting on the feet and ankles where the boots fitted closely.

The skeleton was that of a male somewhat under medium size.

Clothing as follows: body coat of dark blue cloth with velvet collar, buttons which had once been covered, trousers of dark grayish ribbed cloth, stockings plain grey, thin legs slightly ribbed. The waistcoat was so far decayed that its color and texture could be scarcely made out. All the clothing was found to be unbuttoned, when the body was first examined after being thawed.

A woman identified the remains as those of her husband who disappeared in the previous August. She identified him by the clothing and knives which she described accurately before being allowed to see them. She also said that he had been despondent and expressed a desire to die.

Opinon of Medical Examiner was that he died a natural death, in August, '78, having in a state of despondency amounting to insanity crept away, lain down and waited for death, which finally resulted from starvation and exposure.

The case might almost be called suicidal.

The second case occurred in the practice of Medical Examiner Abbott, in September 1879, and was reported as follows:—

Notice given by the Selectmen of Reading, on Monday September 29, 1879 at 10 A. M.

Body found in a swamp near the Lynnfield line on that day. It was discovered by a lad who was in the habit of setting snares for partridges in the woods. The location of the skeleton was at a distance of nearly a half mile from any travelled road. The bones were found reclining against a stump in the swamp, the clothing was unharmed, and the bones of the trunk and limbs even to the phalanges were all in their actual positions. The soft parts were gone. Fragments of the skull were lying about at a short distance, some of them beyond and behind the stump. On closer examination, the clothing was found to consist of a woolen coat, vest and pants, black necktie, straw hat, stout shoes. The straw hat lay behind the body, (an indication of death in summer.) A large old-style horse pistol, was on the ground a little at the right of the right arm, also a copper powder flask. All these being partially covered and concealed with leaves and moss. The pistol was empty, hammer down; rusty. Bones of the head lay in fragments about the body, behind the trunk and at the left side. Scarcely a single bone of the head was entire. The parietal, occipital temporal and frontal bones were all fractured, and also the bones of the face. The teeth were strewn in various directions. An irregular

shaped calvarium formed of parts of the frontal, parietal and occipital bones lay on the ground behind the body. The os hyoides, the thyroid and cricoid cartilages were all in good preservation, and so were the bones of the trunk and extremities. The atlas and a few small phalanges were missing.

Part of the short, gray hair lay on the coat collar.

The left femur was 3-4 inch shorter than the right, the difference being accounted for by an old fracture extending transversely between the greater and less trochanters. This had firmly united. There was no evidence that the remains had been disturbed by any animals larger than maggots, and there were large numbers of the empty shells, or pupa-cases of these insects, in and about the pelvic region.

The only evidence of putrescence remaining was a dark oily discoloration of the lumbar vertebræ, and pelvic bones.

Grass had sprung up between the metacarpal bones and interwoven a network of roots between them.

The clothing, the pistol, and especially the old fracture of the femur were sufficient to identify the body as that of an old man of 70 years, who disappeared from Reading in June 1877, twenty-seven months previous to the discovery of the bones, and the appearances led to the conclusion that he had committed suicide by pistol-shot, the muzzle of the pistol having probably been inserted in his mouth and discharged upward and backward into the cranial cavity.

He had threatened suicide in the last year of his life.

The third case was reported by Medical Examiner Seymour and was as follows:—

The body of this man, a stranger here but identified by memoranda on the person, was discovered June 26, 1885, by a hunter in a secluded and wooded hill-top several miles from any habitation. On receiving notice, I immediately repaired to the spot accompanied by the chief of police and the man who made the discovery and found, first, a revolver, somewhat rusted, lying upon a rock and about ten feet distant, a human body, one chamber of the revolver being empty, suicide was suggested, but death could not have been instantaneous, as the above facts indicate.

The body lay upon the back, the head three feet from the trunk, the hat beside the head, and a respectable woolen suit enveloped the trunk, the first glance at the head, showed it to be simply a skull, no fragment of skin, adipose matter, muscle or ligament remained. On closer inspection, the interior of the skull was found to be entirely empty. Upon elevating the coat collar the disarticulated bones of the skeleton rattled out, and fell into a heap, even the smallest phalanges

being separated from their articulations, like the bones of the head. Every vestige of the soft structures had disappeared; only the osseous frame work was left, and this was disarticulated.

The questions propounded for solution were, how came this man to his death? and what had become of the soft parts of the body?

The evidence in favor of the theory of suicide, were the remote and secluded locality, the pistol with an empty chamber, and the subsequently ascertained fact of the man's mental depression. But no bullet hole could be found in the clothing, nor in the skull; and no stray bullet was found.

The second question was more readily solved, for congregated about the body were numerous carrion beetles which subsist upon decaying animal matter. These scavengers as I remarked, were numerous about the body but myriads of them must have disappeared, for it as was ascertained that barely three weeks had intervened between the time this man left his home in the eastern part of the state, and the day when his body was discovered.

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SUDDEN DEATH DUE TO THE HEART.[1]

BY WILLIAM T. COUNCILMAN, M.D.,
Shattuck Professor of Pathological Anatomy in Harvard Medical School.

IN this paper I shall not consider the cases of death due to the actions of poisons on the heart nor the effect of traumas, although both of these are subjects of great interest. The action of the heart in keeping up the circulation of the blood is one which is absolutely essential to the maintenance of life. Anything that interrupts the continuous circulation of the blood through the lungs and through the systemic circulation brings about at once a cessation of the life of the individual. We are not yet fully informed as to the conditions under the influence of which the heart beats with its normal sequence and regularity. It was for a long while supposed that the action of the heart depended upon the nervous ganglia contained within it. These ganglia are abundant in the mammalian heart, and are situated along the large veins emptying into the heart, in the walls of the auricles, in the auriculo-ventricular grooves and in the basal portions of the ventricles. It was generally supposed that from these ganglia motor impulses passed to the muscular fibres of the several parts, causing rhythmic contraction of these fibres, the sequence and co-ordination of which were due to a co-ordination between the several ganglia in regard to the generation of impulses. There were various experiments which seemed to prove this. It was shown that when the frog's heart was divided in such a way that each segment contained portions of the ganglionic cells, that the segments in connection with the ganglia would continue to pulsate, while those segments in which there was no connection with ganglia would remain quiescent. Thus, if the lower portion of the ventricle of a frog's heart be cut away, it will cease to pulsate, while the auricles and the portion of the ventricle remaining attached to them continue to contract. The heart may be bisected longitudinally without any loss of its contracting power; and the auricles, which in the frog's heart contain the most ganglia, may be cut into small bits. and they will continue to contract.

Recently, however, a number of experiments have shown that this dependence of the heart-beat on nervous impulses proceeding from the ganglia cannot be held without reserve. Portions of the heart, and even strips of its muscular substance, will continue to beat with regularity while immersed in blood-serum. The reluctance of portions of the ventricle to execute spontaneous contraction when severed from the auricles seems to be peculiar to the frog.

[1] Read at the meeting of the Society, October 4, 1893.

In the tortoise, for example, portions of the ventricle containing no nerve-cells will beat spontaneously and with a natural rhythm when separated from the auricles. A consideration of all that can be learned experimentally as to the cause of the natural rhythmic contraction of the heart would seem to show that it is independent of nervous action and due to changes taking place in the muscle itself. In various ways the muscular substance of the heart differs from that of the skeletal muscles. It is not so completely differentiated. The striation, although present, is not so distinct, and the closer division of the fibres into cells, and the anastomosis of these cells with one another, is different from the other muscles; and it is possible that the continuous rhythmic contraction is due to this close anastomosis of the fibres. What part the ganglia play in the contraction is uncertain. It may be that they exercise some trophic influence, or they may serve as depots to distribute to all portions of the heart nervous impulses, reaching them from without.

It is not possible to apply to mammals without reserve the result of the experiments which have been made on the hearts of frogs and tortoises. In these animals the substance of the ventricle is very much looser, and the blood from the ventricular cavity can bathe almost all portions of the muscles. In mammals the case is different, because here, owing to the greater amount of muscle and the closeness of its texture, its nutrition can in nowise be kept up by the blood within the ventricle. In order that the proper amount of blood for nutritive purposes should reach the muscle, the circulation in the coronary vessels is necessary. We shall see that the functional activity of the heart depends more on the integrity of the coronary circulation than on any other factor; and when any impairment of this circulation reaches a certain degree, the action of the heart ceases. The proper function of the heart seems further to be in some way dependent on the proper functioning of all its parts. Impairment of one portion of its muscle by degeneration is frequently followed by sudden cessation of function in all other parts.

We can divide these cases of sudden death coming from the heart into two classes. We can consider, first, conditions arising within the heart which render the circulation of the blood through it impossible; and, secondly, those conditions coming from the heart which interfere with its function, no impediment being given to the circulation of the blood through the heart by these conditions. We will first consider those conditions which arise within the cavities of the heart, interfering with its circulation. We may have, in the first place, as a very rare condition, thrombi of such size formed within the heart that the passage of blood through its cavities is obstructed. The formation of smaller thrombi within the heart is a comparatively common event. They may be formed in either one or both sides of the heart, and the most common place for their formation is within the auricular appendages of the heart. These may become entirely occluded by the formation of thrombi. The thrombi formed in the ventricles, are, as a rule, small, and are seated usually in the trabecular tissue of the apices. These do not give rise to trouble in the heart itself, although when carried from the heart they may

produce various troubles, and even sudden death, by occluding the arteries going to parts essential for life. The thrombi formed in the auricles are, however, rather more extensive. The most extensive formation of thrombi is usually associated with chronic endocarditis and stenosis of the mitral valve. This plays an important rôle in the first formation of the thrombi. The great dilatation of the auricle and its imperfect emptying leads to the stagnation of the blood in certain parts, especially in the appendices. There may be an enormous formation of thrombi in the auricle, and the mouths of one or more of the pulmonary veins may be occluded by the thrombi, without causing immediate cessation of the cardiac action.

Mural thrombi may be formed at the openings of the heart, and may be sufficiently extensive to prevent the entry or the exit of blood. The specimen which I present and which I owe to the kindness of Professor Draper, illustrates this. The specimen comes from a young man of twenty-five who died suddenly. There is an acute endocarditis with vegetations on the aortic valve. In the sinus of Valsalva, behind the anterior segment of the aortic valve, a thrombus has formed which terminates in a large globular mass. It is very probable that during life this floated freely in the aorta. At the autopsy, it was found as it is now, below the valves within the ventricle. It is possible that it may have been forced into the ventricle at the close of the systole, and then on the next contraction of the ventricle may have been wedged into the orifice by presenting a longer diameter, thus closing the orifice and instantly stopping the circulation. The condition is an exceedingly interesting one, and in looking over the literature of heart thrombi I have not found a similar case. It would be difficult to explain the sudden termination of life in any other way.

Of most importance in this connection are the so-called free thrombi in the heart. This condition was first observed by Von Recklinghausen,[2] and described by him in his treatise on the general pathology of the circulation. He describes two cases of marked mitral stenosis in which there were free thrombi the size of small walnuts in the left auricle.

Cases have since been described by Macleod [3] and Hertz,[4] and lately another case has been reported by Arnold.[5] Hertz first brought forward the idea that the free thrombi in the auricle could occlude the auriculo-ventricular valve, acting as a ball valve and so produce severe symptoms, or in some cases sudden death. Von Recklinghausen,[6] in a criticism of the paper of Hertz in which he gives the clinical history of his two cases, takes ground against the ball-valve theory of Hertz. In both of his cases death was not sudden, and there were no symptoms during life which denoted any sudden impediment to the circulation. In one of the cases which Hertz reports there was sudden death, and in the other there were several attacks of collapse which he was inclined

[2] Von Recklinghausen: Handbuch der allgemeine Pathologie des Kreislaufes und der Ernährung.
[3] Macleod: Edinburg Medical Journal, February, 1863.
[4] Hertz: Deutsches Arch., Bd. xxxvii.
[5] Arnold: Zeiglers Beitrage, Bd. viii.
[6] Von Recklinghausen: Bemerkungen zur Abhandlung des Herrn Dr. Hertz. Deutsches Arch., Bd. xxxvii.

to attribute to temporary occlusion of the valve. The same was true in the case reported by Macleod. In the afternoon the patient was seized with convulsions and shortly after became unconscious. The pulse was very small, weak, and the cyanosis extreme. This condition was gradually recovered from, and at nine o'clock in the evening of the same day there was a similar attack which lasted until death, which took place the following morning. In the case reported by Arnold, although there was some evidence of sudden impairment of the action of the heart, orthopnœa and intense cyanosis three weeks before death, the manner of death was not such as could be attributed to a sudden cessation of the circulation. These free thrombi in the heart are always round, their roundness being probably due to their motion within the auricle and probably to their increase in size by the continuous addition of new masses of fibrin. Their origin appears to be always the same. They are associated with the presence of adherent thrombi either in the auricular appendices or elsewhere in the auricle. Long thrombi, sometimes projecting to a considerable extent from the surface with a small base of attachment, are sometimes found adherent to the wall of the auricle. These form the so-called heart polypi of the old writers. These masses can become detached, and from their continual motion, rolling round and round in the auricle, can acquire a round shape. They are necessarily always associated with stenosis of the mitral valve, for with a valve of normal width the masses separated from the mural thrombi would pass through into the ventricle. That they can become a cause of sudden death by closing as a ball valve the narrow auriculo-ventricular orifice appears evident from the case of Hertz and from a case which I observed at the Johns Hopkins Hospital. The case was that of a woman with a history of previous attacks of rheumatism, and the clinical evidences of mitral stenosis. She came into the hospital for the relief of her symptoms of dyspnœa, dropsy, etc., and after being there for a short time died suddenly, falling back in bed when about to rise from it. At the autopsy, the usual changes in the other organs due to mitral stenosis were found. In the heart itself there was a considerable hypertrophy of the right ventricle, with some dilatation. The left auricle was greatly dilated and hypertrophied. The mitral orifice was contracted to a button-hole, which would only admit the first joint of the little finger. There were large thrombi masses in the auricular appendices, and a round free thrombus which was lying on, and occluding the mitral orifice, and partially pressed into this. The thrombus was of circular shape, the surface slightly irregular, and at no point was there an irregular surface showing that it had been recently broken away. There can be little doubt, however, that it had originated from the thrombi in the appendices, and that it had been free in the auricle for some time. The condition is one which is rare, and the cases which I have mentioned are the only ones which I have found in the literature.

The cessation of the circulation may also be due to the stoppage of emboli in the heart. According to Terrillon,[7] emboli carried to the right heart from

[7] Terrillon: De la mort subite par embolie dans la cœur droit. Arch. gén. de Méd., 1878.

the systemic circulation do not always pass through the heart into the pulmonary circulation, but may remain in the heart producing there an impediment to the circulation. In this case, he says that the heart does not cease instantly, but its beats become gradually smaller and scarcely perceptible, and a condition of extreme cyanosis, followed by death, results. In such a condition the embolus must be an extremely large one, and it is probably caught in the ventricle, and from the continuous addition of thrombi to it, it may occlude the orifice of the pulmonary artery.

These seem to be the only conditions which interfere with the circulation of the blood through the heart by obstructing its orifices. We must now consider those cases in which the mechanism of the heart itself breaks down. We may divide these into the cases in which pathological condition is seated in the muscular substance of the heart or in the valves. There are a number of cases reported in the literature of the heart of the sudden rupture of a valve. Generally, the aortic valve is the one ruptured; and the rupture is generally due to sudden and severe muscular effort, and may take place in a perfectly normal individual. The condition is one which may be produced in a dog by passing a sound into the aorta from the carotid, and tearing away one of the aortic valves. There is usually sudden collapse, which is recovered from when the heart's action increases to meet the sudden demand thrown upon it. I have seen one case in which sudden rupture of several of the chordæ tendineæ of the mitral valve was sufficient to instantly stop a diseased and hypertrophied heart. The case was that of a man with extensive visceral syphilis and Bright's disease. He rode to the hospital in a car, and after leaving the car and walking up the few steps leading to the dispensary, he fell dead. At the autopsy, there was found an acute and chronic endocarditis which had affected the chordæ tendineæ, and several of these belonging to the aortic segment of the mitral valve had ruptured, allowing the valve to flap back into the auricle and destroying its functions. It is difficult to see how such an accident could happen in a normal heart; and even should it take place it would probably not result in sudden death.

A very much larger number of cases of sudden death are due to conditions affecting the integrity of the myocardium and its power of contraction. It has been shown by numerous experimenters that a normal circulation in the coronary vessels is essential to the function of the heart, and those pathological conditions of the heart itself which lead to sudden cessation of its action are in the main or entirely to be referred to diseased conditions of the coronary arteries. That sudden death is common in heart disease is a widespread belief among the laity. As a rule, in cases of heart disease of the ordinary type in which there are marked evidences of the condition during life, chiefly shown by the results in other organs of impairment to the circulation, death does not take place suddenly, but is generally to be referred to the gradual increase of the conditions brought about by the impairment of the circulation. Cases in which the trouble lies in the mitral orifice, whether stenosis or regurgitation, or both, rarely or never die suddenly. Sudden death, though not common, may take place in cases of stenosis of the aortic orifice.

In stenosis of the aortic valves the intraventricular pressure must be greatly increased in order to overcome it, and with this there is probably a greater degree of hypertrophy than is met with under any other circumstances. Moreover, stenosis of the aortic orifice is frequently accompanied by, and often the result of changes in the arteries, which in themselves lead to hypertrophy. It is possible that the greatly hypertrophied and dilated ventricle may suddenly have an amount of work thrown on it which it cannot accomplish. In consequence of sudden exertion, or some psychical influence quickly increasing blood-pressure, the ventricle cannot contract on its contents and there is an end. More often, however, the sudden death which takes place in aortic stenosis is due to conditions of the myocardium which may accompany the disease of the aortic valves. Those cases of aortic stenosis which arise after the fortieth year, and have not been preceded by an acute endocarditis are generally due to an extension to the aortic valves of arterio-sclerosis of the aorta. The same process also very generally affects the coronary arteries, and death, in cases of aortic stenosis, is more often due to this affection of the arteries and the changes in the myocardium following it, than to the aortic stenosis in itself.

It is only of late that the important part which the coronary arteries play in the physiology and pathology of the heart has been fully recognized. The two arteries have few or no anastomoses with one another and are distributed to definite sections of the heart, being terminal arteries in the sense of Cohnheim. There is, of course, capillary anastomosis between the various arterial tracts, but there is little or no connection between the larger branches. There is a difference between the various authors as to the presence of and degree of this anastomosis, and there seems to be a marked difference in different hearts. In some cases abundant anastomoses between the right and left coronaries certainly exist as was shown by a case reported by Welch.[8] In this case the right coronary artery was occluded at its origin by a dense sclerotic patch in the aorta. Beyond this the artery was open and it must have received sufficient blood from the left coronary to suffice for its circulation. Stevens[9] found by making injections that communication between the two main arteries and between the various branches of each was sometimes found, but does not think that this anastomosis is sufficiently well marked to compensate for the closure. Sternburg[10] studied by various means of injections the territories supplied by the different arteries. He finds that a large portion of the right auricle, the entire posterior part, and a large portion of the anterior part of the right ventricle, a large part of the inter-auricular, and the inter-ventricular septum, the posterior part of the left ventricle and the posterior papillary muscles are all supplied by the right coronary artery. All other portions of the heart are supplied by the left.

The coronary arteries are among the arteries most liable to disease. They

[8] Johns Hopkins Hospital Bulletin, vol. ii.
[9] Stevens: Lectures on fibroid degeneration and allied lesions of the heart and their association with disease of the coronary arteries.
[10] Sternburg: Ueber Erkrankungen des Herzmuskels in Anschluss auf Störungen des Coronararterienkreislaufes, Dissert Marburg, 1887.

may be occluded by thrombosis or embolism, or have their lumen narrowed or occluded by arterio-sclerosis and atheroma. There is a difference between the two arteries in the liability to disease. The left coronary is more frequently affected than the right, and the descending branch of the left coronary more frequently than any other single branch. If a very small branch of the artery be occluded the circulation in the territory supplied by it may be kept up by anastomosis through the capillaries, but this only holds for a very small branch. Occlusion or narrowing of a large arterial branch is followed by the same result which takes place in any other portion of the body where the arteries are terminal, as in the kidney or spleen. The portion of the tissue supplied by the affected artery will, if the occlusion be complete, be cut off from its supply of blood. This will produce necrosis of the tissue elements and of the walls of the blood-vessels. The area will be pale, anæmic and we have the conditions of the white infarction. In some cases a large amount of blood will flow into the previously anæmic area from the capillaries of the surrounding tissue. The injured blood-vessels will allow free hæmorrhage to take place from them into the tissues and the condition known as hæmorrhagic infarction is produced. In other cases we have a mixture of the two, an infarction with an anæmic central territory, surrounded by hæmorrhage. The infarctions rarely take place except when the occlusion of the artery is sudden and complete as by thrombosis or embolism. The condition which is more common than infarction is one of imperfect nutrition of the heart followed by degeneration of the muscular substance, and produced not by a total occlusion but by a gradual narrowing of the artery. This is due to the ordinary arterio-sclerotic changes sometimes accompanied by atheroma. The nutrition of the tissue may also be affected by arterio-sclerosis without any narrowing of the lumen. The calibre of an artery always conforms to the needs of the tissue supplied by it and varies with the requirements of the tissue. The variations in calibre are produced by contraction of the muscular coat. The essential pathological change in arterio-sclerosis is destruction of the muscular coat, and its substitution by a dense, unyielding connective tissue. This converts the artery into a rigid tube which, although performing the mechanical work of bringing blood to the tissue, cannot vary the lumen to meet the demands of the tissues.

Coronary arteries stand in causal relation with the pathological condition known as fibrous or chronic myocarditis. This condition is characterized by the presence of smaller or larger whitish opaque masses of fibrous tissue which is substituted for the muscular tissue. In most cases it may be seen in the endocardium, and extends from this into the muscular tissue; in other cases it does not extend into the endocardium, and the evidence of its presence is only obtained by making sections of the muscle parallel with its surface. Although spoken of as myocarditis, it probably is not an inflammation, but the fibrous tissue simply takes the place of the previously degenerated muscular tissue which has been absorbed. The process is one which is rarely found in the right ventricle, and is usually confined to the left side of the heart where it

affects the apex of the ventricle and the papillary muscles. It is nearly always due to arterio-sclerosis of the coronary artery distributed to the area, its distribution in the heart conforming to the distribution of the artery most frequently affected.

Most authors agree that fibrous myocarditis is exclusively due to the disease of the coronary arteries. I have recently, however, seen a case which shows that it can be due to other conditions. The case was that of a man who died suddenly a few days after entering the hospital. He had previously been treated for syphilis, and at the time of his death there were evidences of a slight papillar syphilide on his body. His chief complaint on entering the hospital was dyspnœa. At the autopsy there was found obliteration of the pericardium and the formation of dense sclerotic masses of connective tissue in both layers of the pericardium. The pericardium was adherent in its whole extent, and here and there in the thickened tissue some slight caseous material was found. The right ventricle was enormously dilated, being fully as large as a normal heart. All the valves of the heart were normal. Throughout the right ventricle there were numerous masses of fibrous myocarditis, some of which were two centimetres in diameter. They were distributed not only throughout the outer surface of the ventricle, but along the septum. There was also a patch of fibrous myocarditis in the left ventricle, in the septum and a few small patches at the apex. The coronary arteries were normal with the exception of a perfectly circumscribed patch of endarteritis in the left coronary artery around the mouth of a large branch going into the septum. The intima here was thickened and roughened but the calibre of the artery was very slightly affected. Microscopic examination showed that the patches of fibrous myocarditis in the right ventricle were in every case closely connected with the fibrous pericarditis, and it seemed to be due merely to an extension of the fibrous tissue from the pericardium into the myocardium. It was accompanied by a well-marked arteritis of the smaller arteries. There was clear evidence of syphilis given in a fibrous orchitis in both testicles. There is little doubt that in this case the myocarditis was directly due to the pericarditis which was very probably in close relation with the syphilis. The marked disease of the small arteries in the affected foci would point clearly to this. The dilatation of the ventricle was due to the fibrous myocarditis, and the sudden death to the same cause.

Although this formation of fibrous tissue is essentially conservative in its action, supplying a firmer tissue than the degenerated muscle, it is infinitely less resistant than the normal tissue of the heart. It gradually gives way before the pressure in the ventricle and is the cause of aneurism of the heart. These aneurisms of the heart are essentially the same as aneurism of any of the arteries. They frequently contain a large amount of laminated fibrin in their walls. They may form in any part of the heart, but are much more frequent in the apex of the left ventricle. Rupture of the heart, leading to sudden death in a large percentage of the cases, may take place through the walls of such an aneurism.

Death from non-traumatic, the so-called spontaneous rupture of the heart, cannot be regarded as extremely uncommon. I have seen four cases and there are a great number of cases reported in the literature. It would not be within the purpose of this article to enter fully into the literature of the subject. The fullest accounts with statistics are given by Bottger,[11] Barth [12] and Meyer.[13] It may be regarded as certain that rupture, even under the greatest sudden increase in pressure, never takes place in a normal heart. The various conditions of the heart which precede rupture are those due to coronary artery disease. The connection between rupture of the heart and disease of the arteries was first recognized by Barth, and since then has been noted in all cases in which the arteries were examined. The pathological conditions of the myocardium which may lead to heart rupture, are fibrous myocarditis, with or without aneurism formation, circumscribed fatty degeneration, necrosis and fatty infiltration.

The only condition of the heart not connected with disease of the coronary arteries which may be followed by rupture is fatty infiltration. In this condition there is a development of fat on the outside of the heart, beneath the pericardium, which may penetrate beneath the muscular fibres, thus weakening the heart. In the earlier literature several cases of this have been reported, but since the condition of the coronary arteries has received careful attention, there has been no report of this. It must be very exceptional to have such a degree of fatty infiltration that it can lead to rupture of the heart.

With regard to the frequency of rupture of the heart, Devergie [14] reckons it as producing two and one-half per cent. of the cases of sudden death. Aran (quoted from Bottger) found in 202 cases of sudden death with changes in the organs of circulation, 113 produced by affections of the heart without rupture, and 88 by rupture. To both traumatic and spontaneous rupture of the heart the male sex is more disposed than the female. Elleaune [15] found in 18 cases of rupture of the heart, 16 in males and only two in females. In the traumatic rupture the greater frequency in males may be explained by their greater exposure to danger. And in the spontaneous rupture of the heart to the fact that men are more disposed to lesions of the vessels than women.

With regard to the seat of rupture, Ollivier [16] found in 47 cases that the seat of the rupture in 34 was in the left ventricle; in eight the right; in three the right auricle, and in two the left auricle. Bayley has found in 19 cases the seat of the rupture was in 16 the left ventricle, and in three the right ventricle. In 62 cases collected by Bottger, the rupture in 47 was in the left ventricle, in five the right, in five the right auricle, in one the left auricle, one the intraventricular septum, one in both ventricles and in one extending from the right auricle into the right ventricle.

As might be expected the condition is one which is most apt to be found in

[11] Bottger: Ueber die spontanen Rupture des Herzens, Arch. d. Heilkunde, 1863.
[12] Barth: De la rupture spontanée du cœur, Arch. gen. de Méd., 1871.
[13] Meyer: Zur Kenntriess der spontanen Herzruptur, Deutsches Arch., Bd. 43.
[14] Devergie: Médecine Legale, 1840.
[15] Elleaune: Essai sur les ruptures du cœur, Thèse, Paris, 1854.
[16] Ollivier: Dictionnaire de Med., viii.

the later years of life. In 50 cases which Bottger has collected in which the age is given, there were found

Between 20 and 30 years	1
Between 30 and 40 years	2
Between 40 and 50 years	6
Between 50 and 60 years	7
Between 60 and 70 years	18
Between 70 and 80 years	11
Between 80 and 90 years	4
Between 90 and 100 years	1

This is clearly due to the greater frequency of vascular diseases as age advances.

In most cases the rupture is a perfectly clean one making a straight passage through the wall of the heart. This is especially the case when the rupture is preceded by an aneurism. In other cases the rupture does not take place directly through the wall of the heart, but the rupture into the pericardium may be at some distance from the rupture into the endocardium, the blood burrowing into the wall of the heart and making a fistulous passage. In some cases in which the rupture has been preceded by a hæmorrhagic infarction, the hæmorrhage into the muscular tissue is very extensive and from this it appears to penetrate both into the endocardium and into the pericardium. Mettenheiner [17] reports a case in which there was rupture of the myocardium with extensive hæmorrhage beneath the pericardium, which had not penetrated into the pericardial cavity. The pericardium for a considerable distance was separated from the myocardium by the hæmorrhage. Such a case is analogous to a dissecting aneurism. The rupture of the heart sometimes takes place when the patient is quiet and there is no excitement of any sort. In other cases the rupture appears to be due to some sudden increase of the blood-pressure, either brought on by muscular exertion or excitement of some sort.

Wadman [18] reports a case in which in a man, sixty-four years old, rupture took place during coitus, and a number of similar cases have been collected by Bottger. George II, of England, is said to have died from rupture of the heart while at stool, and Philip V, of Spain, on hearing the report of the defeat at Piazensa.

Death is not always instantaneous in rupture of the heart. If the rent be a considerable one and a large hæmorrhage takes place at once into the myocardium, death is instantaneous. A number of cases have been reported in which the beginning of the rupture was apparently marked by fainting and death followed several hours afterwards.

The same effect as rupture of the heart itself may be given by rupture of any of the great vessels within the pericardium. The rupture may take place here, either through an aneurism or through a degenerated spot in the aorta.

In the four cases of rupture of the heart which I have seen, three took place in the left ventricle. One of these was preceded by an aneurism. In

[17] Mettenheiner: Arch. f. Wissench., Heilkunde, Bd. ii.
[18] Wadman: Lancet, 1868.

two, death was immediate, and in one in which there was a long passage between the endocardium and the myocardium, death was gradual. In another case in which an aneurism of one of the sinuses of Valsalva burst into the right ventricle, the manner of death was also slow. I have also seen one case in which death was due to rupture of the aorta within the pericardium. In all of these cases death is not due to the hæmorrhage. The amount of blood found within the pericardium is never sufficient to have produced death. The amount of blood which is found depends upon the rapidity and extent of the rupture. The pericardium is a distensible cavity, and if the pressure be slow it may be gradually distended to a considerable degree before an amount of blood accumulates within it which will be fatal. The death, of course, is due to an increase of pressure within the pericardium, preventing the entry of venous blood into the heart and so stopping the circulation.

In rare cases sudden death may take place from pericarditis. When the pericardial pressure is suddenly increased by the rapid accumulation of an exudation, death may be sudden. In a case autopsied at the City Hospital during the past year in which death took place suddenly, there was a large hæmorrhage into the pericardium which had evidently come from hæmorrhage from the greatly-distended vessels of the pericardium. This case, however, was complicated by an acute myocarditis which may have contributed greatly to the effect of the pericardial exudation.

Rupture of the heart does not seem to follow cases of ulcerative endocarditis even when the ulceration is extensive. In rare cases the rupture may be due to the presence of new formations in the heart or to parasites. Barth found one case in which rupture had first taken place into a large echinococcus cyst of the heart and then into the pericardium.

Although a circumscribed fatty degeneration of the heart due to coronary disease may lead to rupture, this does not take place in the general fatty degeneration of the cardiac muscle, which comes on in the acute infectious diseases. Probably in such cases there may be combined with fatty degeneration a diminution in the force of the cardiac contraction and the intraventricular pressure.

A much greater number of cases of sudden death is due to disease of the coronary arteries without rupture of the heart. This fact is one to which attention has only recently been directed when greater attention has been bestowed on the pathology of the coronary arteries. It is probable that most of the cases of sudden death without apparent cause, which have been reported, were due to diseased conditions of the coronary arteries which were overlooked at the autopsy. Death from this may be the most sudden of any of the forms of death, whether proceeding from the heart or elsewhere. The individual often falls as if struck with lightning. As in rupture of the heart, death may be preceded by some muscular or psychical disturbance, or it may come on without any immediate exciting cause. The cases are usually those of individuals who have passed the fortieth year, and who have not denied themselves the pleasures of life. All the conditions which favor the development of gen-

eral arterio-sclerosis favor the similar process in the coronary arteries. In some cases death has been preceded by attacks of angina pectoris, and it may take place in such an attack.

In almost all cases we find that the arterial disease has produced lesions in the myocardium before death. The most common of these are the more or less extensive patches of fibrous myocarditis. Rare cases are seen, however, in which there is considerable disease of the arteries without any macroscopic evidence of degeneration in the myocardium. Microscopic examination in such cases will usually show rather diffuse hyaline degeneration with slight connective-tissue increase. We can easily understand, supposing the circulation in the coronary arteries to be necessary for the function of the heart, that the instant closure of a main artery or a large branch by embolus should be followed by an instant cessation of the heart's function. But it is more difficult to understand the sudden stopping of the heart without any previous symptoms, in those cases in which the closure of the vessel takes place gradually. Cohnheim[19] has shown that tying off a large branch of one of the coronary arteries for a time produces no symptoms, and then there is a great fall of blood-pressure, and, after a few convulsive movements, the heart stops. There is no doubt that disease of certain of the coronary vessels is more serious in its consequences than others. Sudden death is more frequently associated with disease of the descending branch of the left coronary than any other. The gradual closure of the arteries, with degeneration of their walls and nutritive changes in the myocardium, may go on for a long time with but little impairment of function. The last straw, however, is finally laid on the back of the overloaded camel and the back breaks suddenly.

[The reading of the paper was followed by a demonstration of anatomical specimens by Professor Councilman, illustrating thrombosis, hypertrophy with dilatation, cardiac rupture and aneurism in the wall of the left ventricle.]

DISCUSSION.

DR. HARTWELL, of Ayer, said he desired to express his thanks to the writer of the paper for setting forth so clearly various points relative to cardiac emergencies which had been obscure. Physicians at a distance from populous centres had comparatively rare opportunities to study these cases, and still rarer opportunities to observe the anatomical appearances. It was, therefore, very helpful to hear such a clear and instructive paper on a subject which was especially interesting to medical examiners. He mentioned two cases of rupture of the heart, both in old people and both involving the left ventricle.

DR. SWAN, of Cambridge, reported the case of a man, forty years old, who fell dead at his work-bench. The autopsy found the cause of death to be hæmorrhage into the pericardium through a rent in the wall of an aneurism of the aorta, just above the valves.

[19] Cohnheim and Rechberg: Ueber die Folgen d. Kranzarterienverschliesslung für das Herz, Virch. Arch., 85.

Dr. Hough, of New Bedford, had seen a case of rupture of an aortic aneurism with death in less than a minute.

Dr. Seymour, of Northampton, presented the following communication relative to a case of sudden death in which his right to make an inspection of the body, which had been found dead in bed, was disputed by a physician called in to the case, the reason for the objection being that he, the latter, was of the opinion that the death was caused, probably, by heart disease and not by violence.

"At eight o'clock, A. M., May 22, 1893, I received notice in due form that the body of Mary C. had been found dead in bed, and I was asked to go and view the same. On arriving at the house I was met by a physician who assured me that he had investigated the circumstances of the case, and as he had found the woman had probably died of heart disease, my services would not be required. Not having hitherto made by proxy, my views of persons found dead, I declined to accept the doctor's verdict and insisted on making my own examination, which, after a private consultation between the doctor and a distant relative of the deceased who had been called to the house — the immediate family being out of town — I was permitted to do.

"Subsequently, this physician — a member of the Massachusetts Medical Society — informed me that he had consulted another medical examiner in the county and also an attorney who pronounced my action in the case unwarranted and unofficial. He based this claim upon the clause of the medical examiner's law, which reads that views shall be made upon those persons only who are supposed to have come to their death by violence. In this case he maintained that there was no supposition of violence on the part of any one, hence I had exceeded my authority. If such a construction of the law be correct, the medical examiner in each case of a person found dead, must first go about the streets and inquire if any one suspects violence. If a physician can precede the examiner and dispute his jurisdiction then this law is null and void. But Section II of the law directs that when the examiner has notice he shall go and take charge of the body; and this contemplates the official function that the examiner is to fulfil, and confers upon him all the necessary authority. The first section of the law directs that able and discreet men shall be appointed, and therefore it implies that something must be left to their discretion. A grave responsibility rests upon the medical examiner which cannot be delegated to a second person. Suppose, for a moment a case of criminal poisoning should come under his notice, with a certificate of death from apoplexy by the attending physician. If he should accept such a certificate without making any investigation for himself, he would appear upon the witness-stand at the trial of the case in a state of abject humiliation.

"While the physican may conceive his duty to belong only to his patient, the duty of the medical examiner is primarily to the State. The responsibility of the physician is only to himself, that of the examiner is to the community. If these interests conflict, as they can but rarely, the State must have precedence.

"Finally, the clause 'Supposed to have come to his death by violence' must have an interpretation in favor of the State, rather than against it, and this will always give us jurisdiction in making a view.

"I have reached this conclusion from the standpoint of common-sense. The very purpose of a view is to determine the question of violence, and the medical examiner is the official of the Commonwealth appointed to make such investigation. Mysterious deaths, or the bodies of persons 'found dead,' whose deaths were not anticipated from existing disease, belong to the province of the medical examiner. This would seem to be a truth so self-evident as to render argument in its support superfluous.

"And yet the county commissioners of Hampshire, having had their attention called to this case by the physician who disputed my jurisdiction, have apparently adopted his view. At any rate, they have thus far disallowed the fee, and the chairman said to me that though he had hitherto allowed such bills, he now thought that the statute only intended the fee to be paid when violence was established."

Dr. S. W. Abbott, of Wakefield, spoke of the importance of the subject as a practical question, and said that it was obvious that in a death under such circumstances the element of violence, or its absence, could not be determined accurately except by such methods as the law required in the statute relating to inquests.

Dr. Durell, of Somerville, said that the decision of the county commissioners in this case was like that of a certain other auditing official who had decided that a physician who examined a person, supposed to be insane, had no legal right to the lawful fee for his services unless the person was actually insane, and was so found.

Dr. Hough, of New Bedford, said the rule in his district was to go by the letter of the law, and that the cases of all persons dying suddenly from causes other than violence, were disposed of by the health officer and not by the medical examiner. If the health officer came on suspicious cases within this class, he transferred them to the medical examiner, who ought then to exhaust all his authority, even to the extent of a full autopsy, to ascertain the cause of the death.

Dr. Dolan, of Fall River, suggested that under the law the county commissioners were really superior to the medical examiner in deciding what autopsies were, and what were not, allowable.

Dr. Bronson, of Attleboro, described the usage in his district when he was medical examiner; it was the custom to refer all cases of sudden death from unknown causes, whether violent or other, to the medical examiner.

Dr. Hough, of New Bedford, said the matter lay largely in the control of the undertakers, who sought for the required certificate of the cause of death from the authority where they were the most likely to obtain it easily.

Dr. Presbrey, of Taunton, said this question had always been an open one, and that usage and experience were the best agencies to settle it. The medical examiner's proper function was to act where there was an ex-

pressed suspicion of violence. But there were some exceptions to the rule wherein expediency came in; as, for example, in public institutions where the public interest demanded a medical examiner's investigation in cases of death not specifically due to violence, yet out of the natural course. In the ordinary experience concerning certifying the causes of death, there were three agents: the attending physician, the local Board of Health, and the medical examiner, and the function of the latter was the highest and the one of last resort in doubtful cases.

Dr. Presbrey thought the county commissioners meant to be fair, but that they must go by the law, and must by their criticisms of bills promote public economy. He hoped that medical examiners would follow a conservative course and carry out the spirit with which they began, in 1877, to make the new system less expensive than the old, by avoiding unnecessary autopsies and other expenses.

Dr. Quimby, of Gloucester, said that the decision to which Dr. Durell had alluded was not the practice in his neighborhood, but that the physician's claims are paid, whether the patient is found insane or otherwise.

Dr. Holmes, of Canton, said his practice had been to respond to all calls, and that there had been no trouble about the payment of his fees.

RIGHTS AND DUTIES OF MEDICAL EXAMINERS IN CERTAIN CASES OF HOMICIDE.[1]

BY WILLIAM A BOLAN, M.D., OF FALL RIVER.

DURING the past two years it has been my lot to investigate an unusually large number of violent deaths, among them being two or three cases of homicide, one of which held the attention of the entire world from the time of its commission until long after the famous trial had ended. In a case as sensational and of the notoriety of the one of which I speak, criticism will always be abundant, and the right and propriety of every act of those charged with its solution will be severely passed upon. It is needless to say that such cases are necessarily trying ones to the medical examiner. It is from such homicides as the Borden case that valuable lessons are to be drawn, no matter how long we may have been in office; only the very wise and the very foolish refusing to profit therefrom.

In any case of homicide, the medical examiner should know his powers and be not afraid to use them; always, however, with discretion and judgment. It will be my object in this short paper, hastily prepared, to state briefly what, in my judgment, based upon recent experience, a medical examiner should do when summoned to a homicide.

We will suppose that he has been called to the scene of a tragedy, the manner of the commission and the perpetrator of which are a profound mystery. He should note, accurately, the time of the receipt of the summons and from whom he receives it; the time of his arrival; approximately, at least, the number of people about the place; how he enters the house; whom he sees upon entering the house, and, as nearly as possible, what they are doing. He should take charge at once of the body, or bodies; if plural, putting an officer in charge of each one, with the most positive orders that no one be allowed to touch them but by his consent. He should study well and minutely, the position, clothing and surroundings of the body; the absence, or presence of blood; its color, amount and consistency, if present; the texture of the material upon which it lies, whether carpet or floor; he should take the temperature, using for the purpose his clinical thermometer; he should note the position of the furniture and other articles about the body, and, finally, have the bodies photographed *in situ*, and he is then ready to swear positively in what position he found the bodies and their surroundings, and in the photograph he has a silent, but most eloquent, as well as an unimpeachable witness

[1] Read at the meeting of the Society, October 4, 1893.

to corroborate him. An examination of the wound, or wounds, should then be made, and at that time or subsequently, the autopsy, having first, however, obtained his written authority for its performance; for by so doing he will save painful dilatation in court upon the fact that he did not comply with the statute requiring such written authority. In all cases where there is a question of time, particularly if it be a multiple homicide, the stomachs should be removed unopened, and sent to an expert for examination as to the degree and time of digestion, the amount and kind of food, and for any other matter that the case may demand. The examination of the stomachs played an important part in the Borden case in establishing the priority of death of Mrs. Borden; in fact, without the evidence of the stomachs, such priority would have been difficult to establish. If the injuries are on the skull, particularly if the instrument used is unknown, it should be removed, properly treated and mounted, carefully preserving any small fragments into which it may be fractured. The surroundings of a homicide oftentimes afford the strongest evidence not only as to the manner, but of the perpetrator as well, and when of this importance there should be no hesitation in taking possession of the premises that the evidence of the crime may be preserved.

For removing the skulls you will be roundly abused by a portion of the press, and possibly in court, with more or less effect upon the audience according to the dramatic ability of the cross-examiner. By some of the profession, including possibly a few holding commissions as medical examiners, it will be claimed that it is an unnecessary mutilation, and that a photograph would do fully as well. To the latter criticism, we say that it is absolutely impossible for a photograph to give even an approximate idea of the true condition of affairs. In the famous trial of a few months ago, it was found that there were more cuts on the skull than in the soft parts; it was absolutely demonstrated by the same skull that a hatchet with a blade larger than a certain measurement could not have been the instrument, and it was as clearly demonstrated that one of the hatchets in evidence could have made the wounds, the hatchet in question fitting a wound in the petrous portion of the temporal bone so accurately that it was startling to say the least; no other hatchet, new or old, of practically the same size, approaching it in exactness of fit. In other particulars, the skulls in question proved of inestimable value in determining the position of the assassin, the direction of the blows, the force necessary to cause fracture, and the priority of certain wounds. I do not wish to be considered as an advocate of indiscriminate decapitation in all cases of homicide in which the fatal wounds happen to be upon the head, nor as lacking in the least in respect for the dead, nor as wanting in consideration for the feelings of bereft relatives already rudely stricken; in none of these feelings do I give way to the sternest opponent of decapitation, but justice, oftentimes blind, is always inexorable, and to those sworn to obey her dictates, duty is always paramount to feelings, and justice demanding it, there should be no hesitation in removing the skulls.

A few words regarding evidence. To purely theoretical questions the an-

swer should always be guarded, and never made too positive. To illustrate: It was always a question how the accused in the Borden case could have committed the murders without being very much spattered with blood, and it may be safely said that none of the experts for the government denied that such a condition would naturally follow, some even maintaining that it would be impossible for the assassin to escape without such spattering; yet in another murder, the butchery even surpassing, if possible, that of the Bordens, we found the surroundings bespattered most liberally with the victim's life blood, the instrument used in the murder covered with the same, and yet upon the assailant's clothing, after a minute examination, there was found one solitary blood spot; anticipating the rejoinder that probably the murderer's clothing had been washed, I may add that the clothing showed no trace of such a process. While speaking of evidence, I might say that I was forcibly reminded during the recent trial of the extreme license allowed lawyers in treating the evidence of witnesses. At the preliminary hearing, I stated that a certain hatchet *could* have made the wounds, and that certain spots *might* be blood; yet in this, as well as in the final trial, I was made to say by the defence that the hatchet in question was the one used, and that it was covered with blood, and while endeavoring at the last trial to state that I had never said such things, the statement was objected to by the District Attorney, who later informed me that personal explanations have no place in a criminal trial. In like strain was the attempt to discredit the judgment which sent to the expert analyst certain articles supposed to have blood upon them and found by analysis not to be blood, even though one of the articles in question was subjected to analysis by request of the expert himself.

In conclusion, let me urge fearlessness in performing the extraordinary duties of medical examiner in cases of homicide, remembering that in almost every instance the injustice of a criticism is in proportion to its virulence; and that while in some of our acts we may technically overstep our authority, the community will uphold us when such step is in the direction of thoroughness of work and in the interest of justice.

DISCUSSION.

Dr. Presbrey, of Taunton, said he thought the use of the ordinary clinical thermometer for determining the temperature of a dead body was of limited value, since these instruments register down to 94° only, and are of no use for anything cooler than that.

Dr. Dolan replied that where there are two homicides, nearly coincident, accurate determination of the body-heat is useful in deciding the question of the priority of death.

Dr. Holmes, of Canton, questioned if county commissioners would allow expenditures for photography.

Dr. Presbrey said he was sure that the county commissioners would allow

claims for such expenses if the photographs taken were really a valuable help in evidence; certainly, the district attorney would, if the county commissioners did not.

DR. PRESBREY said he desired to add an expression of grateful, personal appreciation of Dr. Dolan's aid to the medical examiners in standing alone and taking the brunt of the blows in the late Borden case, while other medical examiners profited by his experience.

THE LEACH CASE.[1]

BY THOMAS M. DURELL, M.D., OF SOMERVILLE,
Medical Examiner.

On the evening of April 26, 1891, about six o'clock, I was called to the house of Dr. H. M. Leach, in Somerville, by the doctor, who told me that a servant-girl at his house had been taken with a fit. He said that he had used ordinary restoratives and that they had failed. I went with the doctor to the house and upstairs into a back room. At the head of the stairs we were met by Mrs. Leach, wife of the doctor, who said, "The girl is dead, she died while you were away." Dr. Leach then told me a most plausible story, which was corroborated by his wife, of the girl's previous ill health — that she had had a severe attack of the grippe, was a sufferer from chronic lung-trouble, and was subject to attacks of fainting.

I examined the heart, and found that it had ceased to beat. I also examined the pupils, and in so doing noticed that the nose was very cold.

The whole story was apparently so straight — and there was really no cause for suspicion, except a very remarkable degree of excitement on the part of the doctor and his wife — that I told them that I would sign the certificate, and went away.

Later in the evening, the relatives of the girl called upon me, and told me an entirely different story about her sickness and death. According to their account, the girl had been well up to within two weeks of her death, and they had known nothing about her sickness except what had been told them by the Leach family. They said that the family had told them that Mary was sick, and that the doctor had given her ether to extract a tooth, but that no one of her friends had been allowed to see her before her death.

While this was going on, the undertaker came and said that the bed-clothes and the girl's clothing was saturated with blood.

With these statements I deemed a further examination necessary; and on the following morning I made an autopsy in the presence of Drs. W. D. Swan and John F. Couch.

Autopsy. — Mary Murphy, twenty-two years old. About seventeen hours after death. Rigor mortis present. Dependent parts of the body bluish-purple color. Bloody froth exuding from mouth and nose. Right side of neck swollen. Pupils moderately and equally dilated. Abdomen prominent. Breasts small and flat; areolæ slightly marked; whitish-yellow fluid exuded from nipples on pressure. There was a quantity of gas in the peritoneal

[1] Read at the meeting of the Society, February 7, 1894.

cavity. The parietal peritoneum was opaque and gray. The blood-vessels were injected, and covered over with yellow, flocculent masses. The omentum was dark and friable, glued to the intestines; loops of the intestines were matted and glued together. There was considerable grayish, turbid fluid in the pelvic cavity. The lungs were normal. The heart was empty; its right side was flabby; there was a firm mixed clot in the right side; otherwise it was normal. Spleen soft. Kidneys normal. Liver soft; there was a circumscribed patch on the external aspect of the right lobe, corresponding to a spot on the abdominal parietes, covered with sloughing yellowish material.

On raising the uterus, an irregular-shaped hole was observed in its posterior surface. Immediately behind this, lying transversely in the pelvic cavity, was a laminaria or sea-tangle tent. This tent was about the size of the thumb; one end of it was irregular in shape and corresponded exactly in shape to a hole which was seen in the walls of the uterus. The vagina was of a dirty slate color, and at the posterior commissure was an abrasion through the mucous membrane, the result of violence. The os uteri was patulous and was lacerated by many radiating fissures (the result of violent dilatation). The uterus was three and three-eighths inches in breadth at the fundus and four and one-half inches in depth. The internal surface was covered with decomposing material; and near the fundus were portions of placental tissue, also decomposed. The tubes were normal. The left ovary was normal; the right contained a corpus luteum in the state of a cyst about the size of a cherry. The hole in the uterine wall was plainly to be seen on the inner surface, and extended directly through the substance of the organ. The bladder contained a small quantity of bloody urine; the organ was normal. The brain was normal.

The death was due to septic peritonitis, the result of an abortion.

The case has been tried twice; and both times the jury have returned a verdict of "Guilty." The first verdict was set aside on exceptions, and the exceptions on the second case are now pending.

Some very interesting questions were raised at these trials. The most important of these was the denial of the pregnancy by the defence, and the attempt to show that the material found in the uterine cavity was the result of a membranous dysmenorrhœa, — a disease which Dr. Thomas says that he *thinks* he has recognized five times in his whole life, and of which Dr. Davenport, in his very valuable book on "Diseases of Women," doubts the existence; and yet a disease with which the men and women who testified for the defence, were very familiar; one young homœopathic man having had fifty or a hundred cases of it in a town in Maine of about six thousand souls. This claim was readily set aside; yet I am convinced that in another such case I should have a microscopic examination made by an expert.

Another question was as to whether a girl, pregnant for the first time, advanced three or four months in pregnancy could introduce a sea-tangle tent into her own uterus. This was strongly denied by the government; and yet a man of good standing in Boston came onto the stand for the defence and

swore that from statements made to him by other women, he considered it not only possible, but probable, that this could have been done.

Another of the questions was as to the method in which the tent got into the pelvic cavity. My own theory was that the tent was put in, and after a time an attempt was made to withdraw it, and in so doing the string was pulled out (the string was gone, the end of the tent split, and there were marks of forceps-teeth or something of that kind on the same end); that then the operator became frightened and made a desperate effort to get the tent with the forceps, and that in his efforts he pushed the tent through the already softened uterine wall. This theory was supported by the direction of the wound, that is, in the axis of the outlet. The defence claimed that the girl put it in herself, and that it worked its way up into the cavity (?) of the uterus and then ulcerated its way through. If this were possible, the direction of the hole would have been just opposite to what it was.

The case was most obstinately fought by all the forces which money could provide, with able counsel and all sorts of so-called medical testimony; and yet a verdict was secured in both cases.[1]

DISCUSSION.

DR. W. F. WHITNEY: In regard to the question of membranous dysmenorrhœa. If the examination of the membrane shows the presence of villi of the chorion, that is indubitable proof of the existence of a pregnancy, for these are only formed from the ovum; they can never be formed by the uterus itself, or by any of the processes of menstruation. On the other hand, a membrane is not infrequently discharged from the uterus composed of cells of a character like those in the decidua of pregnancy, the uterus being one in which, as far as can be learned, no pregnancy has taken place. I have made some observations of this kind myself, in which, from the structure of the membrane, I supposed pregnancy to have been present; but this diagnosis later events proved to be an error. The presence of villi of the chorion, which are formed alone from the ovum, and not by the uterus, is the only indubitable proof of pregnancy.

DR. W. A. DOLAN: I have had one case of abortion in which the opening was through the cul-de-sac into the peritoneal cavity, and death, as in this case, was due to septic peritonitis. I took the precaution to have the tissue of the uterus examined microscopically, so that if there had been any question of pregnancy, we could have had that to fall back on.

[1] Since writing the above the Supreme Court has overruled the exceptions in the second case, and the prisoner has been sentenced to seven years' hard labor in the State Prison. T. M. D.

HÆMORRHAGE INTO THE PANCREAS AS A CAUSE OF SUDDEN DEATH.[1]

With Report of a Case of Hæmorrhagic and Gangrenous Pancreatitis.

BY W. F. WHITNEY, M.D., OF BOSTON,
Associate Member.

From its hidden position, the pancreas is, perhaps, the one vital organ which is most frequently overlooked at the post-mortem, and yet its lesions are so important that no autopsy is regarded as complete without a distinct mention of its condition. This is especially necessary in a legal examination, where a person in previously apparent good health is found dead. And in making an examination, it should be the invariable rule after inspecting the greater peritoneal cavity to separate the layer of omentum between the stomach and large intestine, and explore the lesser peritoneal cavity. At the posterior part of this cavity the pancreas should be seen, extending from the duodenum almost to the hilus of the spleen. It can readily be made out as a lobulated gland, the separate lobules of which stand out in slight relief against the fat tissue in which it lies embedded; its more reddish-gray color also distinguishes it. Its shape is roughly like a hammer, the head being spread out along the duodenum, and the handle (or tail) stretching towards the spleen. Its length is about $7\frac{3}{4}$ inches, its breadth $1\frac{3}{8}$ inches, and its thickness $\frac{3}{8}$ of an inch. Its weight is $2\frac{3}{5}$ ounces. Its duct, which will admit a fine probe, opens with the common duct of the liver in the papilla, about six inches below the pylorus, in the duodenum. The mouth of this duct is slit-like, and is not easily found. In practice, a good way is to pass a probe down into the intestine through the gall-duct, which can always be easily found by its bile-stained wall; then to slit up the papilla for a little distance on this guide; and upon careful search, a little opening will be found about one-eighth to one-quarter of an inch from the tip through which the probe easily passes into the pancreatic duct. Occasionally, the duct has a separate opening of its own into the intestine, and then it is more difficult to find. But pressure on the gland will often force out a drop of fluid on the intestine near the papilla, and thus its seat can be located. Examination of the duct should also always be made, as its occlusion or inflammation may be the cause of important changes in the gland itself.

After death the pancreas rapidly undergoes decomposition, and its cellular elements are frequently so altered that but little reliance is to be placed on the microscopic examination.

[1] Read at the meeting of the Society, February 7, 1894.

The pancreas is often the seat of cancer, and fatty degeneration is recorded, an increase of the connective-tissue causing a cirrhosis of the organ; then, too, the duct is frequently tortuous and dilated, or the organ may be partly or wholly transformed into a cyst. All of these changes require time for their completion, and the physician has usually been called long before death, not always able, perhaps, to diagnosticate the exact condition, but, at any rate, convinced in his own mind that death, when it came, was from natural causes.

There have, however, been a series of cases reported, rare, it is true, where a person died suddenly after an illness of which the time had been fixed as varying from half an hour to twenty-four hours, and where the only lesion found was a greater or less hæmorrhage in and about the pancreas. Fitz, in his monograph on acute pancreatitis,[2] gives sixteen cases which he has collected. Since then (1888) only three or four cases have been reported, showing that the condition is one of the rarest that occurs.

From an examination of these cases, it appears that the pancreas is red, usually somewhat enlarged, and the outlines of the lobules mapped out by dark-red lines, for the hæmorrhage almost always follows the interlobular connective tissue, which can be seen microscopically to be fully infiltrated. The amount of blood poured out was, in the majority of cases, comparatively little, perhaps one or two ounces, not enough to be the direct cause of death. There are two or three exceptions to this, one recently published by Seitz, where over two quarts flowed out upon opening the abdomen, and the source of the hæmorrhage was from the region of the pancreas. And this is the only case on record in which the hæmorrhage is sufficient to account for death.

As to the cause of the hæmorrhage, we are as yet entirely in the dark, and also as to the reason of death. None of the theories advanced cover all the cases. One, that the flow of blood over the cardiac axis causes compression of the great sympathetic ganglion and arrests the heart, does not seem to be borne out by the condition of that organ, which is found filled with blood. Another, that the hæmorrhage is due to disturbance of the central nervous system, similar to the hæmorrhages of the lung, meets with little support, as it was associated with this condition in only one case. To say that it is due to a trophic nerve disturbance is to confess our ignorance, as the physiologists have failed to demonstrate any trophic nerve other than the vaso-motor nerve. And until this is done, their lesions can hardly be spoken about. The alcoholic habit has been marked in a number of the cases, but drunkards are not the only ones who have died in this way. Fat persons and lean ones have alike succumbed; the preponderance of the sex, however, is male, and usually past middle life.

What we know on the subject can be briefly summed up as follows: In rare instances, death has suddenly followed attacks of greater or less severity referred to the epigastric region. At the autopsy, a hæmorrhage of varying amount has been found in the pancreas and its vicinity as the only lesion.

This was the conclusion arrived at by Dr. F. W. Draper several years ago,[3]

[2] Fitz, R. H.: Acute Pancreatitis. Cupples & Hurd, Boston.

[3] Trans. Assoc. American Physicians, vol. I (1886), page 243.

and, as far as I have been able to learn, nothing new has been added to it. His cases are the best single series that have ever been presented, and give us more real knowledge than any others.

Although the above covers the entire subject of pancreatic hæmorrhage, I should like to trespass a few moments longer on your time and call attention to the subject of acute hæmorrhagic pancreatitis and its sequelæ, which have been so well worked out by Dr. Fitz in his monograph. I have seen a number of cases, and I have the specimen here of a case of this comparatively rare lesion of which I made the autopsy last week. In hæmorrhage into the pancreas, the extravasation is the only lesion found. There are no evidences of an inflammatory condition in the organ, no cellular infiltration. In acute hæmorrhagic pancreatitis, in which the symptoms are of longer duration, from twenty-four hours to two or three weeks, usually, however, terminating within the first week, we do find alterations in the organ which point to an inflammatory condition. The organ, as a rule, is enlarged. There are single or multiple hæmorrhages throughout its substance, but they are not recent. The blood is not fresh; it has already been changed, and very often it can only be made out from its coloring matter and not from the presence of any of the red corpuscles. With these there may be more recent hæmorrhages, and a greater or less infiltration of the connective tissue with round cells — evidences of an inflammatory condition of the organ. With this is also almost invariably associated a condition which is called fat necrosis. Throughout the fat tissue, especially in the neighborhood of the pancreas, in its interlobular fat tissue, in the root of the mesentery, at times in the omentum, (and in one case reported, all the fat tissues of the body were involved,) are found opaque, white areas, quite distinct from the ordinary tissue. The presence of this necrosis has given rise to a theory, advanced first by Balzer, that it is the primary condition, and the hæmorrhagic pancreatitis is the secondary one. He considers that the changes in the fat tissue are due to disturbance in nutrition in fat people (and it should be mentioned that these cases of acute hæmorrhagic pancreatitis are very frequently associated with an overproduction of fat) in whom the fat has gradually undergone degeneration, has eroded the vessels in their neighborhood, and in this way the hæmorrhage has occurred. Fitz, on the other hand, regards the areas of fat necrosis as due to the action of pancreatic juice or some of its products on the fat tissue itself. Fitz's theory has this point in its favor, that in the greater number of cases the necrosis seems to start first in the neighborhood of the pancreas, where it is always the most extensive, and when it is found in moderate degree it is in that region alone. This would point to its being a local condition, and one referable to the pancreas rather than part of a general condition. On the other hand, such a case as Formad's, where the fat necroses were found throughout the entire fat substance of the body, does point to some cause, central in origin, which causes its destruction in these small necrotic areas. It is possible that some ferment of the pancreas may be absorbed into the blood, and in this way, of course receive a general distribution. For the present, we have to consider each of

these as a possibility. There is no question about the association of these fat necroses with hæmorrhagic pancreatitis. For the causal relation, we shall have to have more light on the subject from the careful observation of future cases, and now that attention has been attracted to it on both sides of the water, it will undoubtedly be found.

In the specimen I have just passed about, we find that the hæmorrhagic pancreatitis is largely of the organ as a whole; the size is rather increased, if anything, but there is no question that it is the pancreas that we have to do with. On the other hand, there is a series of cases (I made the autopsy in one last week), in which, apparently, after one of these attacks of pancreatitis, the pancreas became entirely necrosed, remaining simply a slough. It lies almost as a foreign body in the place where the pancreas has been, and if it were not for the knowledge of what might occur, we should have difficulty in recognizing that it was the pancreas. The notes of this case, which occurred in the practice of Dr. Bush, have kindly been given me by him, and are as follows:

"The case is that of a widow, aged thirty-three, whose family history is good, with the exception of the father who died of cancer of the rectum.

"December 18, 1893. The history obtained was that for a year and a half she had eaten very little food, having had a very small appetite, and had kept up with stimulants. She would not eat regularly; in fact, the sight of food or the odor of cooking produced nausea. Yet at times she would help herself to sardines, cold chicken and such cold lunches as she could pick up from the cold closet or the refrigerator.

"When I saw her she was suffering from an attack of vomiting, accompanied by urticaria, which was very troublesome. The wheals were all over her body. The legs were somewhat swollen about the ankles. There was insomnia. The tongue had a light-brown coat, and there was constipation. These symptoms, with the exception of the inability to sleep, rapidly disappeared upon treatment.

"There were no renal complications and no pain. There was a great deal of lassitude. Under appropriate treatment, these features disappeared to a marked degree, and she was able to take nourishment, the quantity of stimulants taken being diminished, and with the exception of not being able to sleep, she was feeling better than she had been for two years.

"January 14th, she was up and about the house as usual, and in the afternoon was taken with severe pain in the left hypochondriac region. The pain was so severe that it required large doses of morphine, given subcutaneously, to quiet it. At one time two grains of morphine were given within forty-five minutes, the pain being so acute. There was emesis and abdominal distension. There was pain on deep pressure over the above region, and the bowels were constipated. The abdominal pain and vomiting lasted four days, accompanied with marked tympanites; at the end of that interval there were a few movements of the bowels. The general pain seemed to subside, but there was always pain upon pressure from the left back through to the front. The temperature was taken twice a day regularly, and sometimes oftener, but was

never found to be higher than 101.8°. The rate of the pulse averaged 90. She was able to take a certain amount of milk in small quantities, and there was no vomiting for eight days, at which time she obtained some whiskey, of which she drank considerable, and the pain, distention and vomiting recurred. The matter ejected was of a green color, something like crème de menthe, and was mixed with mucus. The stools were extremely fetid in character. There were no urinary symptoms. Death occurred February 1, 1894."

At the autopsy, the abdomen alone was examined. Upon opening it, there was no evidence of any general peritonitis; the whole lower portions of the bowels were perfectly smooth and free, but on looking at the upper part the stomach appeared to be very much distended, and was greenish in color. On puncture, there at once came up a yellowish, thin pus, by estimate two quarts, and, exploring further, it was found not to come from the stomach, but from the lesser omental cavity. Then I suspected it was a case of pancreatic disease. The specimen was removed entire, and afterwards dissected. The stomach and duodenum were opened, and nothing of marked importance found. A probe was passed through the gall-duct, and by this guide the opening of the pancreatic duct was found, which is a little whitish track running about one-half an inch and then opening freely, with a slightly jagged edge, looking as if eaten off, into the cavity of the lesser peritoneum. In this lies a sphacelated mass, all that remains of the pancreas. A little portion of pancreatic tissue is still adherent to the intestine, and the black discoloration is evidence of the hæmorrhage which had taken place at some time into that organ. The pus had burrowed into the root of the mesentery on both sides, but had not broken through into the general peritoneal cavity.

On looking at the case, there is no question that the grave symptoms are of only two weeks' duration; that this extensive destruction of the pancreas could have occurred within that time, seems almost incredible. But we have reason to think that is probably the case. It is possible and even probable that the earlier attack in December was one of acute hæmorrhagic pancreatitis, and the condition continued until the necrosis of the organ began at the time concurrent with the second attack (January 14th), when the pus began to form and the peritoneal cavity to be distended. So this gangrenous pancreatitis is to be looked upon as the result of the hæmorrhagic pancreatitis.

There is still one other form of inflammation of the pancreas associated with the formation of pus within the organ, which is spoken of as suppurative pancreatitis, and in which the disease is usually of long duration. It is a question, perhaps, of months — some deaths, however, occurring within the first month. But, as a rule, it has a longer course than acute hæmorrhagic pancreatitis. It is very rarely associated with any evidence of bleeding into the organ itself, and only rarely with any evidence of fat necrosis.

DISCUSSION.

Dr. J. G. Pinkham: I am not able to throw any light on this subject. I am very much interested in the paper. I have witnessed autopsies in two

cases. The first one was some years ago, before this subject was particularly understood, and the autopsy was made by one of my fellow practitioners. The case was not fully understood at that time, but as I remember it, the pancreas seemed to be simply a mass of blood-clot. The mass was as large, perhaps, as a man's arm. I judge now from thinking of the case that the hæmorrhage into the tissues was very extensive indeed, so that the organ was very much enlarged in this way, and was extremely brittle as we took it out. The case was sent to some one in Boston, but was not diagnosticated as it would be at this time. It was supposed that the hæmorrhage was in the neighborhood of the pancreas, and that that organ was wasted, destroyed by disease, but I think now that the hæmorrhage was in the substance of the organ, and that that produced the peculiar condition that was observed.

In the second case, I was the attending physician. The patient was a baker, a fat man. He was taken with violent epigastric pain, vomiting and great depression. He was treated, as those cases usually are, with remedies to meet the symptoms, and he died after about five days. The autopsy showed the condition which has been described here, the opaque white spots which are not limited to the pancreas, but were visible in the omental fat, and very generally throughout the abdomen. I think other portions of the body were not examined because that was before the attention of the suburban practitioners, at any rate, had been called to this peculiar condition of acute pancreatitis with hæmorrhage. But that evidently was the disease, and that specimen was sent to Dr. Whitney, and upon his diagnosis the certificate of death was based. As a matter of interest, there was some dissatisfaction among the friends in regard to the fact that the man died from such a cause, and the case was reported to a distinguished homœopathic physician of Boston, who said there was no such disease.

Dr. B. H. Hartwell: I have never seen a case of what has been described by Dr. Whitney, but I think that we are under a great deal of obligation to him for bringing anew this matter to our minds. We see a great many cases of sudden death, and I am sure we are puzzled sometimes after an autopsy to state the absolute cause of death. I am sure hereafter we shall not only look more carefully for disease of the pancreas in our autopsies, but shall be better able to tell whether the pancreas enters as a factor in the case, and if any of us should fail to find the pancreatic duct, I am sure there would be some consolation to us in the fact that so eminent a pathologist has difficulty in finding it.

Dr. F. W. Draper: I am reluctant to say a word, because all the necessary words have been said either by Dr. Whitney or by other members of the Society. Two practical points, however, occurred to me in listening to what Dr. Whitney has said; one is that all sudden deaths by natural causes are not to be set down hastily as deaths by "heart disease"; and the other is that an autopsy is not a complete autopsy unless it includes the examination of the pancreas; that it is incumbent upon us as medical examiners to be thorough in our work, and where occasion comes to make an autopsy, to make it so that it can be worthy the name.

So far as these pancreatic hæmorrhages are concerned in their relation to sudden death, I think the anatomical diagnosis is not at all a difficult one, when the lesser omental cavity is opened as it always ought to be for inspection; the case declares itself almost at once; there is no reasonable room for doubt as to what one has before him. The organ itself, normally a pale yellowish white, is in these cases discolored red, and on either side and around the end of it will be found in the retro-peritoneal connective tissue an infiltration of blood that is unmistakable, which one cannot but see if he has ordinary eyes; so that it is not a matter of difficulty in diagnosis, but ordinarily a matter of neglect in the pathologist, that these cases escape observation. In some 4,000 cases of deaths of all sorts, I have seen 19 cases in which there was some pancreatic hæmorrhage, but not in all those nineteen was it to be assigned as the one cause of death. It was in company with other conditions, conditions relating to the liver or to the kidneys, or to the heart or to the lungs, which were complications, so to speak, making the post-mortem diagnosis a little more difficult; but in some nine or ten cases there was no other cause of death. These were the purely typical illustrative cases Dr. Whitney has described so well. They are the cases of persons found dead, about whose clinical history one knew nothing. In only one instance that I recall at this time, did I know the clinical side of the case, and that was, as it happened, the first case I ever came upon. That has been published. I will only state the fact that the symptoms were precisely as Dr. Pinkham has related — great depression, amounting almost to collapse, epigastric pain, with nausea and attempts to vomit, (which generally were unsuccessful), a sinking which resulted in death in forty-five minutes after the onset of the attack. The patient, a man in full vigor, died in the carriage on the way to the hospital, having been seized suddenly, and the appearances were typical and conclusive, nothing else being seen that was abnormal except this pancreatic hæmorrhage into and around the organ.

Dr. Z. B. Adams: It seems to me that there are two very valuable points for the medical examiner in the study of this thing, and the first of these is that sudden death may occur from pancreatic hæmorrhage. It should be borne in mind, and when the medical examiner is called to a case and cannot come to any positive conclusion about it, he should not be content unless he examined this organ after making the usual examination of the heart and other organs. He should not forget that sudden death may occur from hæmorrhage into the pancreas, something, I think, few of us have heretofore taken into account, but since attention was called to it we have waked up to that. Another point is in reference to the cause of death. That, as Dr. Whitney has said, is still a very obscure point; but, it seems to me, if many of these cases should come into our hands, we should soon solve that problem. The cases are so rare, however, that we know little or nothing about that. Speaking of the other forms of pancreatitis, suppurative, etc., I am reminded that some fifteen years ago I had a very stout patient who died after a short illness. I secured an autopsy, and found pus at the head of the pancreas; but at that

time I had heard nothing about this acute form of hæmorrhagic pancreatitis, and really did not know what to call it. I found quite a sac of pus there, and that, to me, appeared to be the only lesion. The symptoms were those of distressing pain in the epigastrium, with vomiting and inability to retain food, constipation, and that was all. He died within a very few days, greatly to my surprise, as I could see no sufficient reason for his death, and that was what I found. As soon as Dr. Fitz's paper came out, I said, "There was my case."

DR. W. F. WHITNEY: In making a post-mortem examination, I should say the pancreas ought to be examined before the heart or any other viscera have been disturbed, because one is very apt to get a false extravasation, which might mislead as to the source of hæmorrhage. The rule should be, after the greater cavity of the peritoneum had been inspected, the lesser cavity should be opened and the pancreas examined at that time.

In reply to Dr. Adams's question, I would say that, personally, I have not seen any cases of sudden death from hæmorrhage into the pancreas from violence or a blow. There are some cases where violence in the neighborhood of the pancreas has been found to be followed by a hæmorrhage into the organ. Dr. Fitz saw the autopsy at the hospital where a man had a railroad injury, and the splenic artery or artery of the pancreas had been torn; in this case he found evidences of fat necrosis in the neighborhood of the pancreas; this had developed very speedily, and is one of the strongest arguments in support of his theory that the necroses are dependent upon lesions of the pancreas.

There are a number of cases reported of extensive injury of the pancreas in which patients have recovered without untoward symptoms.

APPENDIX.

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WHAT CASES SHALL THE MEDICAL EXAMINER "VIEW"?[1]

BY J. A. MEAD, M.D., OF WATERTOWN,
Medical Examiner.

ALL civilized communities have taken away from the individual the right to punish wrong done him, and, in order that the guilty may be more surely punished, and the innocent not unjustly suspected, have established a complicated legal machine that without prejudice or haste shall deal out justice to all. Having thus replaced the rights of the individual, this system must justify its existence by demonstrating its ability to punish the guilty, and to protect the innocent better than did the system it supplanted.

The coroner system, from inherent defects, was unable to do this in a satisfactory manner, and, losing the respect of the community, was abolished. Out of the ruins of this discredited system sprang the medical examiner, who is an important factor in the legal machinery that seeks to detect and punish the criminal. If the medical examiner is to escape the fate of the coroner, he must avoid the mistakes of his predecessor, and prove to the people of the State that his actions are wise and discreet.

I find on inquiring of different medical examiners, representing each county in the State, that there is a decided lack of uniformity in their answers to the question that heads this paper. It seems to me of great importance that this Society should answer this question as definitely as possible, and that the combined wisdom of the members thus expressed should be a proper guide of action for the individual members.

The law under which the medical examiner acts provides that he shall view the "dead bodies of such persons only as are supposed to have come to their death by violence," and that, if upon a view and examination, he is convinced that death was due to violence, he shall set in motion the legal machinery that shall protect the innocent and punish the guilty. It is his early appearance in a legal case that gives to the medical examiner his great importance; and, as the character of the harvest depends upon the quality of the seed, so the result of a legal trial may depend upon the wisdom of the medical examiner. It is his duty to first discover upon and around the body of the deceased the signs of violence that, read aright, give the correct clue to the legal authorities. This evidence is often fleeting, and if not observed early, or if it receive the wrong interpretation, the whole course of justice in this particular case is changed, and the medical-examiner system receives the blame that should attach to the individual.

The office of medical examiner, while affording members of our profession

[1] Read at the Annual Meeting, June 12, 1894.

opportunities for scientific observation and research, was created to render the detection and punishment of crime more certain and effectual. It is with this idea in mind that we must attempt the solution of the question that this paper is discussing.

The phrase "supposed to have come to his death by violence" is very indefinite and elastic; it wisely leaves the medical examiner's field of action unfenced and uncircumscribed. It does not say upon whose supposition the examiner shall act, nor does it limit his action to those cases that are known to be due to violence; in fact, he is to decide this very point by his examination.

The only discussion of this question that I find in the excellent "Transactions" of this Society is the paper by its first president, the late Dr. Hosmer. In his able paper he cites the following case to illustrate his interpretation of this question: "One morning a police-officer requested me to give immediate attention to a case which had occurred five miles away. At much personal inconvenience I responded to the summons without delay. I found in the custody of the undertaker the body of an elderly man, who, early in the day, while in company with a friend, had died suddenly in the street. Careful interrogation failed to discover any suspicion of violence, that death was not a natural one, and also elicited the statement that the deceased had recently consulted a neighboring physician. The fact that the death had been sudden and public was assigned as the only reason for calling a medical examiner. I sought the physician who attended the deceased. On the demand of the instant, he could not furnish the information desired. He promised to investigate and report; in a very short time he wrote me as follows: 'Mr. —— had a marked stenosis of the mitral valve; was moderately comfortable with care. I learn that he had been drinking hard a day or two preceding death.' Such evidence as this fully confirmed me as to the correctness of the conclusion at which I had arrived, and upon which I had acted, when, in the presence of the dead body, I had expressed the opinion that the case did not come within the province of the medical examiner. There was no duty prescribed by law that I could perform, there was no service that I was qualified to render; and, rendering none, I considered myself entitled to no compensation, and have never claimed any."

From the above account it would seem that the policeman's suspicions were aroused by the suddenness and the unnaturalness of the death, and that he thought some one in authority should investigate the case; it seemed to him different from the usual form of natural deaths with which he was familiar, and he was compelled then, it seems to me, to conclude either that it was a violent death, or that it was caused by some natural agency with which he was unacquainted. He was in duty bound, therefore, to refer it to the man appointed by law, and fitted by professional attainments to settle this question. After a careful examination, and a use of the knowledge, the possession of which caused him to be appointed to the position of medical examiner, Dr. Hosmer decided rightly that the death was due to natural causes; but wrongly, it seems to me, that it was not a proper case for the medical examiner to view.

Every medical examiner with much experience can recall similar cases in which the friends or relatives startled by the unusual manner of death, and influenced by that suspicion so useful in a case of crime, and so harmful in a case of a natural death, have accused some one of having given something injurious to the deceased; and this is particularly true if, as in this case, the deceased was a drinking-man. In such views, while the medical examiner contributes nothing toward the detection and punishment of the crime, he does, by establishing the innocence of the suspected person, contribute something towards the protection of the innocent, which is an important result of the law whose object is to protect the innocent, and to punish the guilty.

Dr. Hosmer restricted the duties of the examiner within too narrow limits, and, in subsequent talks with me on this subject, he modified his opinion very materially. He was influenced in writing this paper by the desire that the medical examiner should not fall into the error of the coroner by being too officious, and in seeing this point clearly he lost sight of the fact, it seems to me, that the examiner must, like the district attorney, investigate many cases that prove to be innocent. It is unwise to allow the police-officers or other persons to think that they can decide the cause of death in such cases as that quoted from Dr. Hosmer's paper. An early examination in all doubtful cases should be made by the medical examiner, because, by his training and experience, he is competent to dispel or confirm the doubt that surrounds the case. Not even the physician has the medical examiner's insight in such cases, because it can only be acquired by constant experience and attention to the many problems that such cases present. Just as the practised prospector sees signs of hidden treasure which his experience enables him to locate better than the inexperienced observer, so the medical examiner ought to be able to detect signs of foul play and crime in some detail that would escape the ordinary practitioner. It is particularly in these cases of violence, in which the cause of death is so obscure and hidden that the ordinary observer would decide it to be natural, that the medical examiner does the finest work, and, in order that he may have every opportunity to successfully perform his duty, he should be the first to examine all cases of sudden death.

If from a legal point of view the medical examiner does not have at present the right to view all cases of sudden death, and if it should seem after a careful discussion of this subject that he should have this right, then it is the duty of this Society to ask that the law be amended. Such an amendment will make the safeguards of society stronger and more effectual, and cause the people to have an increased respect for the law that gives them so many proofs of its efficiency and fitness.

DISCUSSION.

Dr. Hartwell: It is twenty-three years ago this month since I received from our governor the appointment as one of the coroners of Middlesex County. Since that time, as coroner and medical examiner, I have been in active service. And from that time to the present the question which has

been so well presented in Dr. Mead's paper has been one in which there has been a good degree of doubt: What cases shall the medical examiner view? It has been my practice to take, perhaps, a somewhat middle ground between the two extremes as stated, the one by our lamented first President, Dr. Alfred Hosmer, of Watertown, that no case should be seen except those in which there was violence, that is, death at the hands of another (I believe that is the best definition of death by violence, death at the hands of another; that is, in which the hands of another had, in some degree, slight, it may be, had something to do), and that which is stated by Dr. Mead, that the medical examiner should view all cases of sudden death, or death in which there is no physician in attendance. Is that the right interpretation, Mr. President? The paper stated, I believe, that the medical examiner should view all cases. It has been my practice to take rather a middle ground, erring, if at all, on the side of the Commonwealth as against the person. I think it would be impossible for the law to state what cases the medical examiner should view. Therefore, the law well provides that the governor "shall appoint able and discreet men" — I believe those are the words — he shall appoint able and discreet men as medical examiners, because in this matter of determining what bodies he shall view, so much depends upon the judgment and good sense of the medical examiner. We are human, to a certain extent selfish; and we can, if we wish, acting for self, put something to our bank account in performing our duties as medical examiners.

If you remember, the law provides that "When a medical examiner shall be notified that there is lying within his county the dead body of a person supposed to have come to his death by violence," etc. Now there is a great deal of latitude of meaning to that word "supposed," a great deal of latitude of meaning in that word "notified." "Notified" by whom? "Supposed" by whom? Fortunately, in the County of Suffolk that matter does not come in, but it does throughout the other portions of the Commonwealth. In the cities, it is taken away to a certain extent, because to a great degree there the medical examiner is notified by the police. But in the country districts, where I, fortunately or unfortunately, have served, any one may notify: sometimes a selectman, occasionally an undertaker, occasionally a neighbor, and it may be hearsay evidence. I have been notified by a person driving into the village, "There is a dead body there." Shall I go? I ask him, "Do you know anything about it?" "No." "Was there a physician in attendance?" "I don't know. That man died there very suddenly." That is all I can learn. Shall I go? It has been my practice in such cases to inquire as far as I can before going. My district is a pretty long one. The town of Ashby is seventeen miles away, ten miles by cars and seven by carriage. I receive a dispatch by telephone that a child was seen to fall into a well — actually seen — and was drowned. Shall I go? I call up one of the selectmen and talk with him; learn that the family is in good circumstances, their character above reproach, and that the child was actually seen to fall and meet with its death. I say, "Bury the body," and I don't go; thus I

save the expense to the Commonwealth. Do I do right? I believe so. So that, to a certain extent, or as far as may be, I call up the selectmen or those in authority and learn what I can before going. Possibly it is not right. I say, if we err at all we should err on behalf of the government; that is, we should view all bodies where there is a doubt; we should so make our views that afterwards there may not come up in the minds of the community a doubt as to whether violence had something to do with the death of that person or not.

Now there are a great many laws in the Commonwealth which are similar to this one. Here is one. Most of our country places are under the jurisdiction in minor matters of district courts. But the selectmen of any town in the Commonwealth can have a justice appointed by the governor who shall have authority to issue warrants. This is frequently done. Now, there is a small town in the Commonwealth in which a man holds this appointment from the governor as justice of the peace with the power to issue warrants. That man is a most estimable one, a member of the legal profession, practising at the Massachusetts bar, chairman of the board of selectmen of the town in which he lives. Not long ago he issued ten warrants on a single case. He gets a dollar for each warrant and he got ten dollars about as quick as it takes me to tell it. Two boys got drunk, assaulted some people in the town, broke into a house and stole, were arrested and locked up, and broke out. Five warrants were issued against each of those boys, making ten in all: one for getting drunk, another for assault and battery, a third for breaking and entering, a fourth for breaking out, and a fifth for larceny. If that case had been brought before the district court, two warrants would have been issued without expense. No doubt the gentleman acted to the best of his discretion — I would not question that. There the same point comes in that comes in with reference to us. Shall we make this view and get five, six, seven or eight dollars from the county, or shall we not? It has been my custom, as I said, to take the middle ground.

The law states that the bodies of all persons killed upon a railroad in the Commonwealth shall be viewed. We have no discretion there. Then I think there is another class of cases which, in consideration of the stringency now of the Employers' Liability Laws, we should view in every instance, and that is where a man is killed who works for a corporation. Every case of that kind, I think, should be viewed without question. Then a third class of cases which should always be viewed, I think, in consideration of the exactness of those laws, which, it seems to me, are being tightened and strengthened every year, is that of every person who is killed who is in the employ of another within the Commonwealth. The body of every such person should be viewed. And then there is another class, forming perhaps the greater portion of those we are called upon to view, and that is cases of sudden death, a majority of which are from natural causes — perhaps all from natural causes, and a large majority, when we come to investigate, without any question as to violence. There is where, it seems to me, we are called upon to exercise our discretion. The

points have been so ably brought out by the paper of Dr. Mead that when I have elaborated, perhaps at too great length, some of those points, I think I have fulfilled all that the president would expect of me.

DR. MUNSELL: Mr. President, I would like to inquire of the gentleman who last had the floor, in regard to suicides. He did not include those, I believe.

DR. HARTWELL: I did not. I think that every case of that kind should be viewed. That is violence, criminal, I believe, in some States. I think in France, in Maine and in New York an attempt at suicide is a criminal offence.

DR. HURD: Mr. President, I am one of the newest members of this Society. I was very anxious to hear this paper to-day, for I was in hopes to get some hints from it that would be of instruction to me in my work. The majority of sudden deaths that take place in our vicinity are from drowning. This summer we have had a number of cases of death by drowning where there was no ground for supposing that any violence was used — which were accidental — and still where it seemed to me that the medical examiner had a mission to fulfil. For instance, a schooner was wrecked off our harbor a little over a month ago. There were some seven persons drowned. The schooner was washed ashore. If the crew had stuck to the vessel, they would have been all right, but they preferred to leave the vessel and venture out in a yacht. The yacht evidently upset, and they were all drowned. The next day the schooner came ashore safe and sound. Now, as those bodies were successively washed ashore the question came to me, What is the use of a medical examination here? Well, in the first place, in respect to identification, as far as possible. And then, in the second place, it was the medical examiner's duty to direct when they should be buried, etc. Still, there was no suspicion that any of those deaths were deaths from criminality. Nevertheless, it seemed to me that cases of that sort, even if there had been fifty of those bodies and one after another should drift ashore, were proper cases for the medical examiner.

Now, last week I had a dispatch from the Chief of Police of Amesbury to come to that town, as the body of a child had been found in a lake adjoining the village, but asking whether it was necessary to have a medical examination. Well, in such cases of drowning the impression certainly is that there should always be a medical examination, where formerly a coroner's inquest was always called; and although the circumstances of the drowning of the child were perfectly well known, yet it seemed to me that it was a proper case for a medical examination, and I went. And yet I have some misgivings as to whether it was the proper thing to do. There were two or three witnesses to the drowning of the child. It happened in a little lake in the neighborhood of Amesbury. Two or three little boys saw the drowning, but were not able to recover the body, and it was two or three days before it was found. In that case it seemed to me a matter of doubt whether I ought to have put the government to the expense. And every little while, we are likely to have

such a summons as that, where if we go in response to the summons it takes several hours, we go to a good deal of trouble, and we can hardly afford to do it unless we are paid for it.

The impression is abroad that in all cases of sudden death we should attend. I do not know of any rule that can be laid down in such cases as that of death by drowning, as to what is the part of the medical examiner and how far he is warranted in declining to go, and saying, "I don't believe any examination is needed here." In regard to cases of sudden death, with us we have a good many cases of people who are found dead in bed. Those cases should always be investigated. And yet the other day I declined to make a medical-examiner case of one of that sort. An undertaker came to me and said he could not get any physician to sign a certificate. I went down to see about it. I found that it was a clear case, where a woman had had a shock, and yet they had had no physician for two or three days. There I simply signed the certificate and declined to make any charge to the Commonwealth, it seemed to me so plain a case. I think the matter should be left to the discretion of the medical examiner. There are cases where it is not proper to make a charge. In regard to the drowning of the little child, I do not know that it was proper to attend. Still, I should be inclined to lay down the rule that in cases of accidental drowning it is proper for the medical examiner to attend and make a charge.

Dr. Hoitt: Mr. President, I have listened with a great deal of satisfaction to the paper of Dr. Mead, and also to the able remarks of Dr. Hartwell and Dr. Hurd. It is a serious question to take into consideration, what should be considered a medical-examiner case; and I think it is a pretty serious matter for the medical examiner, because we are often called upon to view what the laity may consider a medical-examiner case, where our attendance is entirely unnecessary. In fact, to-day the people seem to have a queer idea of what the duty of a medical examiner is. In my district it often seems to be the impression that the medical examiner is to settle all causes of death where a physician was not in attendance, or even if he has been in attendance, where the patient has died suddenly, that it is the medical examiner's place to attend to it. I have had several cases of that kind. As regards drowning cases, I am annoyed quite a little. Within the last week a boy went out in a boat — was seen by people to go out in a boat, fall overboard and drown before assistance could get to him; and the people were indignant because I did not think it was a medical-examiner case, and they were also indignant because the State would not employ a diver to search for the body. I have had cases of that kind; but as Dr. Mead states in his paper, I think it is our duty to investigate all cases where there is a doubt — to take the benefit of that doubt. There are several cases which I have investigated where I have not put in a bill, because I thought the State would not uphold me in it. I find that in cases of drowning where persons skate through the ice, where they are seen to go through, physicians do not care to give a death certificate but will refer the case to the medical examiner. Then there are other cases that have come up.

There was one case — I think it was about ten years ago, where I was chided by the district attorney; but it is the only case that I have had any trouble about, and I will cite the case to make it more lucid. There was a jeweller in the city who had no friends nor relatives nearer than a great-aunt. He was given to drink at times, and when he got on his periodical sprees his companions were of questionable character. The night before his death he was seen in the streets with them, having a considerable sum of money on his person. Not getting up at his boarding-house the following morning, about eleven o'clock they looked over the transom and thought he was dead. Notice was given accordingly to the city marshal, and I went and looked over the transom, broke the door open, found him dead, and made an autopsy. I found he had died of heart trouble. I put in my fee of thirty dollars, a fee of five dollars for one medical witness and two dollars for another, and sent the bill in. The district attorney wrote back to me and wanted to know on what authority I had made the autopsy. I told him on the authority of the mayor, and stated on what grounds I deemed an autopsy advisable. The bill hung fire nearly a year, while the district attorney investigated the case thoroughly. His brother, I believe, was medical examiner down on the Cape somewhere, and I understand he told him he should have done as I did. But there was a question whether I should be paid for that autopsy.

Then, in the case of drowning, where I go through an examination and give the cause of death, although there is no doubt that the child or the man fell into the stream — shall I be paid for that? It is a hard matter for us to draw the line. I was thinking the other day, why should not a medical examiner be paid a regular salary, proportioned to the average number of cases of death from violence in his district, and let him investigate these cases and give a death certificate where no physician is in attendance. I don't know why that would not be reasonable. As we all know, although there may have been abuses under this medical-examiner law, still there have been very few cases where removals have been made for abuse of the office; but even with the abuse of the office, experience has shown that it is the cheapest way of investigating death from unknown causes.

As regards death from violence, I should agree with Dr. Hartwell. Death by violence I should consider death by the hands of another, or by one's own hands. I think a suicide is as much a death by violence as homicide. I look upon that in that way. I had a case day before yesterday where the city marshal notified me that a woman, who had not been seen for a week or more, had been found in a house hanging by the neck, and was evidently decaying. I went into the house and found that she was a maiden lady, and she was hanging at the balusters of the stairs. Sure enough, the body was in a state of slight decomposition. People at once said, "Possibly that woman was hung there; she had money." Now, there was a case of suicide which I think should be thoroughly investigated. There is a chance for doubt, and I think that such a case should come under the jurisdiction of the medical examiner and be well investigated. I have made autopsies where I have not put in a

fee for the same. And by the way, I would like to ask the medical examiners having small cities and small towns in their jurisdiction, what is their custom as regards witness fees. I have not put in a witness fee for any witness until within the last year. I have had the appointment now some ten years, and I never put in a witness fee until the last year, because my colleagues in the medical profession are always willing to witness an autopsy and lend their aid if I wish it; but within the last year I have put in a five-dollar fee for one, and two dollars for another. I have talked with other medical examiners and find that they do not put in a fee for their brother physicians. That is a point which is, of course, foreign to the subject under discussion, but it is interesting and also instructive. There is another matter to which I will refer, and I was very much pleased that it was taken up for discussion — the matter which came up before us a year or two ago about the embalming of bodies; and I think that should be a subject for discussion, because there is no question but that it oftentimes frustrates our work.

DR. PRESBREY: Mr. President, the subject is one to which I have given no thought with a view of speaking upon it, and yet it is the subject of everyday consideration with us. I know perfectly well how the community meets the subject in the beginning (except in the case of Boston), and it meets it with the statement that the medical examiner is quick to run to the case, for he gets five dollars and his mileage; he is quick, too, at an autopsy, for he gets thirty dollars and his mileage. That is, perhaps, the people's feeling, and that is what the secular press are inclined to jump at, and they are inclined each year to proclaim to the people how much I received as medical examiner and how much work I have drawn into my hands, trying to make a large fee for myself. I think that is a low-lived, mercenary side of the case. We are here to do a certain duty; we are entitled to a legitimate fee for it. Certainly, we ought not to rush in to the work of examination, work of view, work of autopsy, for the sake of the fee, and I hope there is no medical examiner who does it. The medical examiner was the outcome of a system which had proved itself corrupt, and above all things we should take great pains ourselves that we do not emulate any of the peculiarities, not to mention virtues, of our predecessors. It seems to me, however, that on the other side it is to be said that a death without attendance, without any suspicion of foul play whatever on the part of anybody, if you can imagine such a case as that, perhaps is not a case for the medical examiner. But it is extremely hard to draw the line. There are many families in my experience who welcome the medical examiner in a case of sudden death where there is no real feeling or suspicion of violence; but they welcome the medical examiner as the official recorder, the official observer, the one who comes under these circumstances to learn the facts of the case, to take notes of it, to thoroughly inform himself concerning it and commit the facts to writing, so that in case a question may arise afterwards, he can be referred to and can bring the case to further investigation. I have met with that experience repeatedly among our people, and have felt that they have welcomed the work of the medical examiner. I think this

question is an open one, and one that is difficult to settle. It is difficult for me to throw light upon it, especially as I have not heard the paper. It is a question that needs careful and thoughtful study. The financial side is not a very nice side, but it is a side for us to look at. I don't know but that we ought to do these things without pay, but I don't believe we are called upon to do so. I don't believe the State appoints us to do gratuitous work. If we feel that we legitimately ought to do these things, we ought also to legitimately feel that we ought to have our pay for them. I think I have heard more criticism on the part of court officials to the effect that the medical examiners have not gone to the extent of making full examination and autopsy than ever I did of the fact that they have gone to an unnecessarily full extent. I think the tendency of the legal mind is that we should do our duty in every case to the last degree. The tendency of the secular press is perhaps a little upon the other side. Possibly the truth lies between the two.

Dr. Jack: Mr. President, I would like to say one word in regard to the question of the legal mind concerning a case that came up, not within my district, but within the district of Dr. March, of Winchester. Dr. March happened to be away, and I was summoned by a messenger to view the body of a dead man, and on investigation I determined that the cause of death was due to natural causes. This man had been a hard drinker for many years, and at the time he died he was under the care of the Keeley Institute in Lexington, and the question naturally arose at that time whether the remedy he was taking (he was taking the home-treatment) had anything to do with his death. On careful examination and inquiry in regard to the case, I determined, as I say, that the death was due to natural causes, and I made out my papers to that effect. I received a letter from the judge of that district, asking, if the death was due to natural causes, what was the need of the medical examiner. I wrote him in reply, saying that the need of the medical examiner was to determine that very fact, that the death was due to natural causes. I did not say anything more, but left the question there.

There was another case which came up with me in the town of Stoneham. I was called to see a man who had been killed by the falling of a building. In investigating the case, I found that the man had lived an hour after being taken out from the ruins of the building, and was attended by Dr. Cowdrey of that town. I said to the chief of police, "This is not a case for a medical examiner. Dr. Cowdrey is perfectly competent to report the man's injuries and certify to the cause of his death." A day or two after the chief of police telephoned me, "What are you going to do in regard to that dead man?" I said, "Nothing." I stated the facts to him and the law in regard to medical examiners, and made it clear to him at that time; and he agreed with me at that time that it was not a case for a medical examiner. But a few days after he telephoned me again, saying that the judge of the district court thought that I should make a report. They said they did not think they could inquire into the cause of what made that building fall unless they had some medical examiner's certificate as to the cause of the death of that man. I wrote a

letter to the judge of the district court, Judge Johnson of Woburn, stating the facts of the case, and saying that I did not think it a case for a medical examiner, and had not seen fit to make out the papers for the district attorney. Those two cases have caused me some trouble in regard to the legal side of the question of my work.

DR. CUTTS: Mr. President, I had a similar experience to that of Dr. Jack, a few years ago, and I think it shows the uncertainty of the law governing the duties of the medical examiner. Death by violence is open to interpretation from several standpoints. There was a suicide about two months ago. The man lived some hours and had several physicians in attendance, and I allowed the physician in charge of the case to sign the death certificate. I was summoned, but it did not seem to be a case of death by violence, according to my interpretation, and I permitted the attending physician to sign the certificate. I did not hear from it for about a day, and then the agent of the board of health called me up and wanted to know why I had not signed that certificate. I told him why I had not. He told me it was customary in Suffolk, at least, to sign death certificates of suicide, so I promptly rectified the mistake. Now in Brookline, I have authority from the town to view cases of sudden death without medical attendance, in addition to my commission as medical examiner. So that in such cases, for instance, as death apparently from heart disease or something of that kind, of which I have been summoned to see several, I have not sent in any record or made any charge to the county, nor have I to the town, for that matter, because I have not seen fit to. But it seems to me rather a good idea that the medical examiner or some physician should have authority to view bodies of persons dying suddenly but without any suspicion of violence. I think the law is a little ambiguous. It seems to me to require a great deal of discretion, because cases apparently similar are in many respects dissimilar — it certainly requires a great deal of judgment as to what to do.

Subsequently to this case just mentioned of suicide, I had another case — both cases of shooting in the head; and I made no bones of reporting that, and sending in a charge for it, because, the board of health having seen fit to call on me, I thought they took a proper view of it. I should say that we had better err, as a former speaker stated, upon the side of the Commonwealth and make the view and make the charge — not for the sake of the charge, but because we have done our duty, and let the county commissioners, if they see fit, throw out the charge. I think that is the way out of it, a step that will help us, where we are summoned by some one in authority, at any rate — the police officers or the selectmen or somebody in authority in the town — make the view, and make our charge for it.

DR. PRESBREY: Mr. President, in answer to one suggestion made by my immediate predecessor, that there should be some one to make views of unattended and uncertified deaths other than the medical examiner, it seems to me that the answer to that is made by law already, for there is such an officer — I don't know how it is in towns, but there is in the cities; that is, the board of health

have the duty of ascertaining the cause of death in cases uncertified and unattended, other than cases which have about them, directly or indirectly, however remotely, the suspicion of violence. That is the usage in the city in which I reside, and the chairman of the board of health is quite in the habit of looking up unattended deaths and making the certificate. But if in his looking up he finds any occasion for doubt, if there is anything about it that to him is not quite clear or satisfactory, he then sends to me, stating, "I have viewed this case, I have been to look this case up, and I feel that it is a case which you officially should see." Well, I go officially and see it under those circumstances, and I think it is perfectly right and perfectly proper that I get my fee for it. But, of course, in a majority of those cases I cannot find any more than he found. But when he finds anything that would lead to suspicion, he does not feel like signing the papers, and it seems to me that is a very just and proper way for him to do, even if I cannot find anything. But at any rate, I have been and I have my records, and if anything afterward comes up, the first step has been taken which may lead up to an inquest later.

DR. HOITT: Mr. President, if the Society will bear with me a moment, that recalls to my mind a case similar to that spoken of by Dr. Presbrey, where I was called to a case where the patient, a woman, was in the third week of typhoid fever, and the selectmen had issued an order that no drug stores should be kept open on Sunday. That was in a town in my district, within four miles of me. She was taken with a sinking spell and the doctor came who was called for, and he dispatched her husband for some liquor. He went right by a saloon which was never known to be closed on Sunday or any other time, went to a drug store and attempted to get in; he could not get in, and when he got back his wife was dead. The attending physician gave as the certificate of the cause of death, "Died for the want of proper medicine, which could not be procured on account of the compulsory closing of the drug stores on the Sabbath." The consequence was that the chairman of the board of health, who was a homeopathic physician (the attending physician was one of our school) and did his duty, of course, could not accept that as a cause of death, and the case was referred to the trial justice, and he referred the case to the medical examiner for the district, and they sent for me. Of course, I did as Dr. Presbrey has done; I made my view and charged for it. Of course, I could give no cause of death. The judge asked me, "Would you consider that the patient died from the want of medicine which could not be procured?" I said, "No. Liquor, like other remedies, is not infallible; I could not say that that was the cause." But that was a case where there was a great stir and a great cry against the homeopathic physician and closing the drug stores on Sunday. The consequence was that the drug stores were open on that day; they gained the point. The State had to pay to make that view, of course. There was a case where I should feel that we were justified in putting in a fee.

DR. MUNSELL: Mr. President, I have been extremely interested in the discussion that has been going on in reference to this paper. But I find my asso-

ciates all land in about one place after they cite their cases. It seems to me that the whole matter is left discretionary with the medical examiners. Sixteen years ago, when the law was passed, I received my appointment from Governor Rice, and I read the law over and over. The more I read it, the more I became confused in reference to what cases demanded my attention and what did not. I was then zealous to conform strictly to the law, and I wrote to Hon. George Marston, who was at that time our district attorney, and I have his reply now in my possession, and the closing sentence was this: "You had better make ninety-nine uncalled-for views, than to let the one-hundredth go by." And I have thought of that a great deal, from the fact that we might in our haste let a case go by that did not strike us then as being of importance enough to make an expense in the matter. Perhaps in a week or two we begin to hear suspicions in the whole neighborhood, and when suspicions begin to arise they grow with great rapidity, and the medical examiner is the one that has to suffer, and I think that it is worth five dollars and mileage to quiet these suspicions that will run through a neighborhood and get up discord and feeling in regard to the matter.

I had a case week before last that illustrates this. I heard my bell ring between eleven and twelve at night, and was called to come hurriedly to the residence of a neighbor who lived about a mile away. You know in Barnstable County, or Cape Cod, we do not live very near together; we live a good ways apart. I harnessed and went at once. I did not know what the case was. I found, as I drove into the yard, a number of the neighbors, who said that the captain — that was the man of the house — had fallen down the cellar stairs, and they thought he was dead. They had brought him up and laid him on the bed, and when I went in, sure enough, he was dead. And by the first viewing of the case externally, I saw no marks of injury, especially no bruising and no blood on the first examination. As I stepped out into the other room one good lady said, "I don't know about this case; it seems to me as though it looks a little suspicious." There had been some one around the house, she said, the night before, and the night before that, and they thought he was trying to get into the house, and they thought perhaps there was trouble. I made up my mind at once that that was a case for thorough examination, and I examined the body and I found that a portion of the skull was fractured. Then I went into more minute examination to see how that could have been done and where. I took the light and went down cellar and viewed the location of things there, and I found on the corner of next to the lower step, the place where the injury to the skull, in my own mind, had been done, from the fact that there was a little hair there and secretion, showing, in my own opinion, that that was where he struck. Then how did he happen to go there? That was another point. It seems that he heard some kind of an alarm outside of his house, and his wife says he got up and started, she supposed, to go to the door. She heard a noise and thought she heard him fall, and sure enough, he had gone to the wrong door, fallen down the cellar stairs and killed himself. I made that a case of viewing and shall present my bill

for it, and think it right that I should. In my opinion, almost every case — take the case of drowning — unless you see the body fall into the water, or have good and sufficient witnesses who saw it fall into the water, that is one thing; but if there are two or three persons out sailing a boat, it might be that there was foul play somewhere. At least the examination of the report of the medical examiner ninety-nine times out of a hundred, will settle all suspicions that arise, and I think that for that reason, if I err I should do it in the interests of the community and perhaps not be so extremely partial to the best interests of the Commonwealth.

DR. HARTWELL: I should like to say just a word. I thought that what I said in one point in particular might be misconstrued; that is, if we err, err on behalf of the Commonwealth — not in a mercenary, pecuniary manner, but for the good of the Commonwealth. That is, make the view that the laws may be enforced, that the individual, the neighborhood may be protected. That is what I meant when I said if we are in doubt, err on behalf of the Commonwealth; that is, make the view, so that if there is any doubt it may be cleared up, and that the laws may be enforced of the Commonwealth which we represent.

SUICIDE OR HOMICIDE? A CASE FOR MEDICO-LEGAL DIAGNOSIS.[1]

BY C. S. HOLDEN, M.D., OF ATTLEBOROUGH,

Medical Examiner.

THE case to which I will call your attention does not perhaps invite you to assist me in deciding if it be one of suicide or homicide, as the title states, so much as to ask for an opinion as to the manner in which the several wounds found on the body were received, and as to whether they were all post-mortem or ante-mortem.

The subject, Patrick McCarthy, of North Attleborough, an old man of sixty-five years, living peacefully with an unmarried son and daughter, a man possessed of no property, but a very useful member of the household, and of good habits, left his home in cheerful spirits after eating breakfast, Saturday, the eighth day of July, 1893. His absence from dinner was unusual; and when he did not return for supper, search was immediately begun for him. He was last seen about nine o'clock that forenoon, leaving a saloon which was situated about a quarter of a mile from his residence, where he had drunk twice of ale. He lived in a thickly-settled portion of the town, was well known, and because of his kindly manners was a general favorite.

The next morning, two men, while rowing in a boat on a pond about a quarter of a mile from where McCarthy lived, and about the same distance from the saloon, saw, perhaps twenty feet from the shore, the gray head of a man, apparently floating just beneath the surface of the water. The body was taken to the shore, identified as that of McCarthy, and I was called to view it.

The posture of the body was that of semi-sitting, and it was properly clothed. The head, face and neck were covered with cuts and bruises. The most striking features were the loss of the right ear, a large denuded surface on the right side of the neck which exposed the opened external jugular vein, and the absence of all blood from the clothing.

An autopsy was made that afternoon and the following facts were ascertained: The body was that of a man well nourished, rigor-mortis was present, and cadaveric hypostasis was marked on the face and the upper part of the chest. The palms of the hands were blanched and wrinkled, and crepitation was noticed by pressure applied to the right side of the chest down as far as the nipple. As was stated, the neck and face on the right side were the seat of many injuries. Beginning with the nose, on the right side there was a cut one inch long, the tip of the nose was denuded of skin and a

[1] Read at the Annual Meeting, June 12, 1894.

V-shaped cut extended through the cartilage separating it from the bone. Just below the right eye was a scratch three-fourths of an inch long. There was a bruise on the cheek one inch in diameter; three other smaller bruises on the cheek, from which the skin was partially denuded. The right ear was separated from the side of the head leaving a jagged irregular edge, the auditory canal being filled with clotted blood; below the ear and in front was a denuded surface two and one-half by one and one-half inches wide, the lower border irregular in outline; in this wound the opened external jugular vein was seen. Behind and slightly above the right ear was a scalp wound one and one-half inches in diameter; below and behind this was a cut two inches long that did not go through the scalp; leading into this from above was a cut one inch long and from below a cut an inch and a half long. Above and three inches behind the right ear was a cut three inches long extending through the scalp, and in this region was several other cuts and scratches from two to three inches long.

Passing to the internal examination of the body, the lungs, deeply pigmented, were prominent and did not collapse after the sternum was removed; both were firmly attached to the thoracic walls, the pleural cavities being nearly obliterated. On applying sufficient force to remove the lungs much water tinged with blood escaped into the thoracic cavity. A ligature was applied so as to include the trachea and the large blood-vessels, and the lungs and heart were found to float in water. Pressure applied to the cut surface of the lungs caused the escape of a watery fluid, in fact, the lungs seemed to be saturated with water. The heart, opened under water, showed the escape of bubbles of air or gas; the left side of the heart was nearly empty, while the right side was filled with soft clots.

The abdominal organs were normal; the stomach contained about four fluid-ounces of light-brownish colored fluid.

On removing the scalp, areas of discoloration were noticed beneath the external wounds. The brain was normal and the skull was not fractured.

The wounds found on the face and neck and described as cuts and bruises were peculiar in appearance. The cuts, with one or two exceptions, would perhaps more properly be described as deep scratches. The denuded surface on the neck was deeper at its upper portion, gradually growing more shallow until at its lower border the line was irregularly notched.

A second visit to the pond in which the body was found and a more careful examination of the premises, revealed agencies that could possibly have caused some of the injuries noted. Along the shore of the pond, about fifty feet from where the body was found, was a short section of barbed-wire fence several lengths of which were submerged. Although there was no current in the pond, it is perhaps possible that the face or the body came in contact with the barbed wire causing the injuries. This may have been the case, although one would suppose that if the body had been in contact with the fence a sufficient length of time to cause the injuries, the clothing would have become attached to it. The bottom of the pond is composed of soft mud, there being no stumps

of trees or large stones anywhere in the vicinity. The other injuries might have been due to the body being struck by a row-boat, although it seems hardly credible that an ear could be severed from the body in such a manner.

An inquest was held, but no decision has been made by the judge. The medical evidence was to the effect that the cause of death was drowning, and that the wounds were probably received after death in some manner unknown.

DISCUSSION.

DR. PINKHAM: Mr. President, the paper is a very interesting one. It is quite remarkable that so many and such injuries should be found on a dead body under such circumstances. The question of suicide or homicide seems undetermined and indeterminable. The case is one of those mysterious ones that occasionally come under our observation. It would be quite possible, as the reader has stated, for the sharp barbs of this wire fence to make many of the injuries. When we come to consider the question of self-inflicted wounds, it seems incredible — in fact, I might say, impossible — that any man intending to kill himself should make that number and kind of wounds and in those positions. Neither in the matter of homicide, if we supposed that those wounds were inflicted by some one in killing the man, would they be likely to present such a variety. All the wounds would be likely to be inflicted with some one weapon, either a sharp weapon, or a club, or a stone, or something of the kind, and the wounds would all bear more or less of the same character. It seems to me that we must exclude, so far as the wounds themselves are concerned — which probably were not sufficient to cause death — we must exclude both homicide and suicide. In regard to the cause of death, it appears from the reader's report to be drowning, either suicidal or accidental, and the conclusion reached in regard to the manner in which the wounds were inflicted, is probably the only one that could be reached on the facts presented.

COMMENTS ON A CASE OF HOMICIDE.[1]

BY A. H. HODGDON, M.D., OF DEDHAM,

Medical Examiner.

MARY E. was an unmarried woman of seventy years, who had resided upon a small farm in a remote portion of the town of Dedham.

She had formerly been a school-teacher, and was a person of fair education and much respected. For a year before her death, a young German named Hoffman had lived with her, and at her request had procured a second German from Boston to perform some laborious work. A few days after this, on Hoffman's return to the place late in the afternoon, both Miss E. and the second German were missing. Subsequent search revealed the dead body of Miss E., doubled up in a small closet and stiff in rigor mortis. There were no marks of a struggle in the house, and from the appearance of the beds and table, it was evident that Miss E. had met her death some time after early morning.

A superficial examination of the body showed finger-marks about the throat and blood on the floor and on the clothing about the genitals.

An autopsy on the next day revealed the following: Rigor mortis still present. The labia minora presented on the left side extensive ecchymoses on their inner surface, varying from one-half an inch to one inch in diameter, and on the right side a distinct ecchymosis the size of a French pea. There was a discharge of blood from the vagina and distinct laceration of the fourchette on the posterior portion of the vagina to the extent of one inch. The chest, and especially the upper portion thereof, presented purplish discolorations, marked here and there frequently by very dark purple spots somewhat elevated, which on section were found to be effusions of blood into the true skin. This same condition appeared on the face. The tongue was slightly protruded and held between the closed teeth. The mouth contained much vomitus. On the removal of the scalp there was found evidence of frequent blows upon the head, but no fracture of the skull was discovered. The tissues of and about the trachea showed distinct effusion of blood. Both lungs were engorged with blood, and the bronchi contained partly-digested food, as did also the larynx, trachea and œsophagus.

The fluid removed from the vagina was carefully examined under the microscope, and was found to contain no spermatozoa.

The cause of death was certified to be suffocation induced by throttling and by inhalation into the respiratory tract of food thrown up by the stomach;

[1] Read at the Annual Meeting, June 12, 1894.

and it was also certified that an attempt had been made to commit rape, an entrance into the vagina having been made.

At this point the case came to a standstill for over two years, when at last, the supposed author of this crime having been betrayed to the police through the offer of a reward, was taken, indicted and tried.

It seemed probable that the murderer had throttled and stunned his victim first, and then, while attempting to commit rape, had so pressed on her abdomen and stomach, as to force the contents of the latter up into the pharynx and mouth. Yet at the beginning of the trial it was found that a former district attorney had so drawn the indictment that the charge of murder during an attempt at rape had not been distinctly made, and owing to this, a conviction of murder in the second degree only was obtained. Undoubtedly rape was the prime object of the assault, and that, too, when the woman assaulted was seventy years old; and the question was asked by the defence whether atrophy and shrinkage of the parts would not render connection impossible. The autopsy, however, showed a fairly patulous vagina. The absence of semen probably showed want of emission. How long semen would withstand putrefactive changes while still in the vagina seems to be still undetermined, as there appears to be no record of time in such cases. While dry, in stains on clothing, they are said to have been detected by Bayard after six years, and by Roussin after eighteen years. The defence held that simple ocular inspection was not sufficient to determine whether the tear in the fourchette was recent or not, and their experts contended that the tear should have been excised and the sections submitted to the microscope. The punctated effusions and ecchymoses on which Tardieu has laid so much stress, were very marked over the chest and face; and these, he asserts, although they may appear in cases of suffocation from compression of the chest wall, are best marked and most characteristic in death by strangulation.

The medical evidence in this case was conclusive, and no real effort was made to gainsay it. Although the remaining evidence was largely circumstantial, it was sufficient to convict the prisoner of murder in the second degree and he was sentenced to State's prison for life, escaping a death sentence undoubtedly very largely from the flaw in the indictment above alluded to.

Another occurrence in this trial ought, it seems to me, to be spoken of here. In this trial, and at one other which occurred shortly after, a regularly appointed medical examiner of this State appeared as an expert for the defence, engaged by the defence for this purpose and in one case, at least, paid by the defendant. Such action occasioned much comment and surprise at the time, and the propriety of such conduct was at once doubted. The question of our status as medical examiners with reference to the State arose. Are we State officials now and for all the while we hold our commissions; or is our official life an intermittent one that can be taken up and laid down as duty or emergency may demand? Are we counsellors looking with a partial eye at each case; or are we true experts, seeing each case with an impartial eye? The statute under which we are appointed simply says that the Governor

"shall nominate and by and with the advice and the consent of the Council, shall appoint in each county able and discreet men, trained in the science of medicine, to be medical examiners in such county"; it then goes on to define our duties, giving no indication, however, bearing on the subject in hand. A former attorney-general of this State once spoke in my hearing with a great deal of warmth on this matter, saying that if he knew of a medical examiner appearing against the government, the medical examiner would not hold office long. Upon just what ground he stood, I could not see, unless he should persuade the Governor and Council that such conduct was sufficient cause for removal. That the lawyers do not agree upon this matter, any more than on many others, is shown by the letters from two district attorneys of this State lately received by me, and which I will now read:

DEAR SIR: — I do not know what the feeling of other district attorneys may be, but personally I can see no objection to a medical examiner testifying either for the Commonwealth or the defendant in a criminal trial. It seems to me that if the expert had his true position in litigation, such a question would hardly arise.

However, even now, although we are accustomed to consider experts as a species of counsel, sometimes fairly so, I am not prepared to say that the medical examiner is under a retainer to the Commonwealth. I see no objection to his assisting in discovering and declaring the truth in any disputed case, whether he do so as a witness for the Commonwealth or the defendant. I am very truly yours,

W. H. MOODY.

On the other side is the following:

DEAR SIR: — I think that the medical examiners should not appear as experts against the Commonwealth in other districts than their own. They are officers of the Commonwealth. There seems to me to be the same impropriety in a medical examiner so doing that there would be in a district attorney defending a criminal outside his district. Very truly yours,

JOHN A. AIKEN.

I am inclined to side with the latter view, and must confess that I have always considered myself a State officer, but not necessarily a "species of counsel." For us to appear on the side of the defence in opposition to another medical examiner, weakens our position and at once lowers us to a "species of counsel." The whole matter is one of opinion, but to me it has seemed to show a lack of propriety and good form to stand with the defence and opposed to the Commonwealth in such cases.

DISCUSSION.

DR. PRESBREY: I think the question opened is an important and large question. I don't know that it has ever occurred to me before to consider whether a medical examiner had a right to be employed, while he was yet a medical examiner, upon the side of the defence; and it is plain enough that there are some arguments upon both sides. I do not know that I am prepared to say, if I was called upon to appear as against another medical examiner, or apparently against him, what I should do. I hope I shall not be called in that

position, because it is not a nice one. It has a suggestion of compromising to me that I do not like. I cannot help feeling that the highest view of the position of the medical examiner is the view last mentioned, and, as this writer has maintained, that we are, not perhaps retained by the Commonwealth, but that we are officers of the Commonwealth, and as such we have really no right to exercise that special function for an individual. After our commissions have expired, I suppose we are at liberty to do as we like. I cannot help feeling myself, if I had a case in which I was appearing in court, doing my best, that if one of you gentlemen should appear in court as an expert for the defence, I should have a little sense of chagrin, a little wish that we could have both been, not nominally pitted against one another, because very likely we should both tell the same story from whichever side we saw it — it is to be hoped we should; but there is a feeling to me that it is not quite the highest position that a medical examiner can occupy.

The PRESIDENT: I should like to say just one word about this matter as it strikes me, as we have but a short time. It is to this effect, that it lowers the medical examiner in the eyes of the community to appear against another medical examiner in any criminal case. It cannot fail to make him fall in the estimation of the public. Dr. Draper has a resolution which he would like to offer, that I would like to hear discussed.

DR. DRAPER: Mr. President, this matter seems to me so important, and the abuses growing out of the practice referred to in the paper are so obvious, that it seems desirable that the Society should make an explicit statement of its opinion upon this question. I have no doubt in my own mind that the position taken by Dr. Hodgdon in the conclusion of his paper is the correct one. I have no question that it is a distinct lowering of the *morale* of the medical examiner's position to have upon one side the medical examiner of the district, and engaged upon the other side a neighboring medical examiner, brought in for the very purpose of disputing the position, or, at all events, of modifying the position taken for the government. Of course, it is very obvious that the appearance of the medical examiner acting as a medical expert for the defence, is designed by the counsel for the defence to shake the strength of the government's position, and I am sure that any medical examiner who lends himself to that end, to hurt the evidence of a brother medical examiner, is approaching the line of unbecoming conduct, if he does not transcend it. And I think that under the circumstances related by Dr. Hodgdon in his paper, we have an opportunity to stamp our disapproval upon that conduct, and that as a society we might at least call a halt on the part of the medical examiners if they are inclined to do that sort of thing. I therefore move, Mr. President, the passage of the following:

"*Resolved*, That, in the opinion of the Massachusetts Medico-Legal Society, it is improper and objectionable conduct in medical examiners to accept service as medical experts for the defence in trials for homicide in this Commonwealth."

The resolution was seconded by Dr. Paine.

DR. PINKHAM: I would like to inquire if Dr. Draper intends that the scope of the resolution shall include cases out of the State?

DR. DRAPER: Not at all, sir. It applies to Massachusetts alone. We are, as has been said here, State officers, and as District Attorney Aiken, in his letter to Dr. Hodgdon said — it is language which I have myself used — it is as improper for a medical examiner to appear in the defence against a brother medical examiner as for a district attorney to appear in the next district against the district attorney of that district.

DR. PINKHAM: Well, I would like to ask if it is considered improper for a district attorney to appear for the defence in a case in the next district — if it is so regarded?

DR. DRAPER: I think it is, very decidedly.

DR. PINKHAM: Now, gentlemen, continuing my remarks, I would say that I am heartily in favor of the resolution. I think, perhaps, as the matter has not been discussed before, it is possible that some medical examiners, members of the Society, may have entered into this work without due reflection, and that it would be perhaps a little unjust to censure them too severely, the matter not having been discussed and being one that they have not probably thought very much about; but still I think it is a very proper position for the Society to take. We, of course, in our position in trials are not advocates. The testimony that we give may be in favor of the government or in favor of the defence. We occupy — that is the view that I take of it — an entirely independent position. I am just as ready, as undoubtedly every member of the Society is, to state a fact, and state it clearly, that is favorable for the defence as one that is favorable for the prosecution. And that being the case, any medical examiner who takes a distinctly opposite position to that, who goes into another district and takes the position of a witness for the defence, has lowered himself. It is an improper position. It is not only the fact that he is standing up in opposition to a fellow medical examiner, a member of the Society, standing up against him, but he makes himself in a certain sense an advocate, as all hired expert witnesses are. The position is one which, certainly, no honorable member of the Medico-Legal Society should occupy.

DR. PRESBREY: Mr. President, I would like to make a suggestion, but it is not that I object at all, as you saw by the remarks that I made, not knowing that this was to follow, that I am really in sympathy with this plan. But if we are to pass a resolution of this kind, it is supposed to have an effect, possibly of censure, but it is to have a great deal wider effect, I should think, than that; an effect of guidance and advice for the future. And in order to have that effect it is manifestly well that the subject should be brought thoroughly home to the thought of every individual member of this Society. And under those circumstances, while I am ready to vote for this resolution, I wish to make this motion as a suggestion, and I am perfectly willing that it should be dropped if you do not agree with me: that instead of voting upon this at the present time, it be left upon the table to be made one of the special pieces of business for the coming meeting, and that this resolution as a subject for busi-

ness be spread upon the notices of the next meeting in full, with a statement that it will be discussed and acted upon then. That will bring it home to every man and give every man a chance to come and speak his mind, and then he will know the subject is up and know it will be discussed, and when we have acted on it he will not be surprised to get a notice that such is our vote.

The PRESIDENT: Gentlemen, you have heard the opinion of Dr. Presbrey and his motion that this resolution be for the present laid upon the table, to be brought up at the next meeting by special notice given by the secretary. If that is your wish will you please to —

DR. DOLAN: Mr. President, I would like, if it is allowable, to say a word there. I think the matter is so ethically wrong that it is almost belittling to the Society to spread such a vote upon the record. As the stenographer is here I think it will be in the reports of this meeting, and this discussion will be sent by our secretary to every member of the Society, so that I think really, without spreading any such motion as that upon the records of the Society, everybody will receive due notice of it.

DR. HURD: Mr. President, I am in favor of the motion as Dr. Draper has read it, and of acting now.

DR. PAINE: I should like to see it laid over. We have not a large number present, and if they are all notified of it I think we can get a large number out.

The PRESIDENT: The question is on the motion of Dr. Presbrey that the resolve be laid upon the table. (The question was put and the ayes and nays appeared about equal.)

DR. PRESBREY: Mr. President, I am not at all strenuous to do this for any reason except to be of the best service to the Society —

The PRESIDENT: The Chair is entirely in doubt about the vote, the way it stands.

DR. PRESBREY: If those in authority think it would be better to pass it I will cheerfully vote for it. I was only trying to make it the most effective that I could.

DR. DRAPER: Mr. President, I don't know as there is any motion before the meeting; at the same time, I will say that I think there can hardly be any room for discussion here. Everybody, it seems to me, will be on one side if we discuss it all day, and therefore what advantage will there be in postponing to the autumn meeting a matter in which there will be no difference of opinion?

DR. PRESBREY: If you will allow me — it is evident that two gentlemen of our number have felt that there was sufficient reason for them to think differently and act differently.

DR. DRAPER: One only. Two medical examiners, but only one member of this Society.

DR. PRESBREY: Well, there is one, at least, that can come forward and give some reason why he did it. Perhaps he is repentant; I only hope he is. I only want to do justice to those and to ourselves by so doing. I am not at all strenuous about the postponement of the matter, because I am in sympathy with it.

DR. PINKHAM: I think, Mr. Chairman, it had better lie on the table and give the gentlemen who are implicated by it and will be censured by it, an opportunity to be heard in their own defence. It is hardly fair to condemn a person unheard.

DR. DRAPER: To that I would remark, Mr. Chairman, that it is not a specific censure; it is not intended as such. It is to establish a principle of action. It was not intended to be retroactive, but if any gentleman can put the coat on and it fits him, we are not responsible for that. Only it should establish, it seems to me, a rule of action that should be binding upon members of this Society in the future.

The PRESIDENT: What is your pleasure to do with this resolution? I will listen to a motion to lay it upon the table.

The motion to lay the resolution upon the table was renewed and seconded, and carried unanimously, after which the meeting adjourned.

NOTE. — At the next stated meeting of the Society, October 3, 1894, the Resolution was taken from the table, discussed briefly, and passed without a dissenting voice.

DEATH SUPPOSED TO HAVE BEEN CAUSED BY VIOLENCE.[1]

BY Z. B. ADAMS, M.D., OF FRAMINGHAM,

Medical Examiner.

"But is this law?
Ay! marry is it; Crowner's quest law."

THE following is copied from the Record-book of a medical examiner:

"The weather was cool. Attention was called to the house by the bad odor issuing from it. At 9.15 A. M., May 28th, I entered the room, which had been closely shut. The body was found lying upon the left side in bed. Wherever exposed it was completely covered with huge white maggots. The surface was black from decomposition. The eyeballs had burst, and the belly was inflated with gases. The skin fell off wherever touched, and the odor was fearful. It seems incredible that all this could have taken place in the short space of eighty-six hours, in cool weather, and the entrance of flies prevented by closely shut doors and windows. A considerable sum of money was found under his pillow. No suspicion of foul play could be entertained."

Certainly this was a disagreeable case; but the duty of the examiner was absolutely repulsive when he was obliged to sign a printed "return of view" stating that "the death was supposed to have been caused by violence."

And perhaps more disagreeable still would have been the experience, if, as in the case cited by Medical Examiner Seymour, of Hampshire County, another physician and an attorney, consulted in regard to the matter, had pronounced the action of the medical examiner in returning a "view," as being unwarranted, and apparently the county commissioners had coincided in this opinion.

The chief ground of complaint against the language of law is found in its redundancy. To secure precision and avoid ambiguity the writers of our laws strive, whether by amplifying, restricting, or otherwise defining the meaning, to remove all chance of equivocation. Thus the statutes are overburdened with verbiage. But in the law relating to medical examiners (a law, be it remembered, the aim of which is to discover homicide, to protect the innocent and punish the guilty of the heinous crime of murder), and in the most vital point of this law, is introduced a phrase so loosely drawn, so vague and unprecise, that scarcely two intelligent men can be found who will agree upon its meaning. One might even be permitted to infer that in drafting Section 10 of Chapter xxvi., it was intended to imply that medicine being confessedly an inexact science, legal phraseology applied to medical questions should be likewise inexact.

[1] Read at the meeting of the Society, October 3, 1894.

"The phrase 'supposed to have come to his death by violence,'" says Dr. Mead in his excellent paper read before this Society in June last,[1] "is very indefinite and elastic; it wisely leaves the medical examiner's field unfenced and uncircumscribed. It does not say upon whose supposition the examiner may act, nor does it limit his action to those cases which are known to be due to violence; in fact, he is to decide this very point by his examination."

This is admirably stated. Still every medical examiner must experience a cold shudder of disapproval when called upon to state, in a plain case of death from natural causes, that "death was supposed to be caused by violence."

The first and obvious meaning of death by violence is death caused by the hand of another. Clearly this excludes suicide and accident, whereas deaths from these two causes constitute the bulk of cases of violent death which the medical examiner is called upon to "view." No one can doubt that these are proper cases to view. This, then, cannot be the true definition of the words of the statute.

But violence may mean any injury which happens to the body from without. Neither can this be the meaning of the statute; for such a definition omits cases of sudden death from natural causes which the medical examiner, as I will show further on, is very properly called upon to view. These are cases of unexpected or unexplained death, where either no physician was in attendance, or the cause of death seems obscure and perhaps liable to suspicion. To quote Dr. Mead's language upon this point, "Suspicions are aroused by the suddenness and unnaturalness of the death . . . different from the usual form of natural death with which every one is more or less familiar." The conclusion of the bystander "being either that it was a violent and unnatural death, or was caused by some natural agency with which he was unacquainted."

Some cases of death from natural causes may by a forced construction be placed under accidental or violent deaths. Such, for examples, are rupture of aneurism from muscular effort, fatal hæmoptysis in phthisis from violent exercise, a perforation caused by vomiting in ulcer of the stomach, disease of the heart ending in sudden death while straining at stool, etc.; but such accident or violence cannot have been contemplated in a statute devised to detect and punish the crime of homicide. There are cases occasionally where there is evidence to show that death resulted from natural causes when in matter of fact it was due to gross violence. In a case of sudden death where every evidence was at hand to prove the existence of disease of the heart, an unsuspected fracture of the frontal bone was found, caused by a fall. Again, an infant was buried without a certificate, the undertaker being satisfied by representation made by the family that death was due to convulsions, when the autopsy, three weeks afterwards, revealed a fracture of the skull, the result of the brutal carelessness of its drunken father.

But such cases of violence or homicide do not sufficiently show the value of the present form of the statute. *One* of its undoubted objects is to detect crime where slow or subtle poisons, or some unusual methods are employed,

[1] See page 166.

which produce a fatal result with symptoms similar to those of natural death; and another purpose is to detect and punish the abortionist. Of the first class we have a fine object-lesson in the well-known case of Mrs. Robinson. Of the second class, is the case recited by Dr. Durell at a recent meeting,[3] where, on the representation of a doctor, he was on the point of issuing a certificate of death from natural causes, when accident revealed the fact that a crime had been committed.

Dr. Mead says, "The office of medical examiner was created to render the detection and punishment of crime more certain and effectual"; and we may add that it is precisely in these cases of secret or concealed homicide that the medical examiner may render the greatest service to the community.

A prejudice in favor of an individual, or what is called "popularity," may screen a cunning criminal, as, on the other hand, malevolence may bring suspicion upon the innocent; indeed in cases of sudden or unexpected death it is not safe to leave the question of the cause to the decision of the family, the police, the board of health, nor even of the doctor. There is a distinct advantage in an inquiry of this kind in calling upon a stranger, as it were an indifferent spectator, to whom all the facts are submitted anew, who can view the case from a new standpoint, whose sympathies and interests are in no way involved, and who, moreover, by special training and experience is competent to decide upon the testimony.

It is claimed that the law has worked well. How can that be shown when, on the one hand, we have no means of knowing how many cases of secret homicide may have escaped detection under the guise of death from natural causes; nor, on the other, how often a groundless suspicion may remain in the minds of the community against an innocent person?

It is to be regretted that no statutory provision exists authorizing the medical examiner to make post-mortems at his discretion in cases of unexplained death.

Both the State and the medical examiner would be the gainers by such legislation. In case a secret homicide should be revealed in this manner, the value of the law in its widest possible interpretation would be proved, while the medical examiner would have no difficulty in recovering payment for his labor; whereas if, as no doubt would happen most frequently, no crime was brought to light, not only might a cruel suspicion be removed from some innocent person, but much knowledge would be gained upon doubtful questions connected with sudden death, while mortuary statistics so far as they are based upon medical examiners' certificates would possess far greater value than now.

I would suggest that Section 10, of Chapter 26, of the Public Statutes might be amended acceptably as follows:

Medical examiners shall make a view of the dead bodies of such persons only as are supposed to have come to their death by violence; or, when called upon, when the death is sudden or the cause of death is unknown; in which case they are hereby authorized to make a post-mortem at their discretion, such post-mortem not to be returned as a medico-legal autopsy.

[3] See page 152, Transactions for 1894.

I append to my paper the following from a member of this Society:

August 23, 1894.

DEAR DR. ADAMS: — I am a little shy about trying my hand at tinkering statutes, and that is why I haven't replied sooner to your request.

I am not thoroughly convinced that it is desirable to amend the law. While I am in favor of the widest and most liberal latitude in the discretion under which medical examiners act, and while I believe (as I have always acted) that a medical examiner should not inquire closely into the character of the "notice" by which he is summoned, but should presume that in the mind of the one summoning him there is a good reason for the summons, I do think that the clause "such persons only as are supposed to have come to their death by violence" is a useful clause *sometimes* as a bar to frivolous calls and to calls clearly outside the function of the medical examiner, considered theoretically.

If I were commissioned to formulate statutory provisions which would conform closely to my own practice during the past seventeen years as a medical examiner, my suggestion would take this shape:

(1) Omit Section 10 of the present law altogether.

(2) Amend Section 11 by omitting the words "who is supposed to have come to his death by violence," and substitute therefor the words "into the cause and manner of whose death a medical inquiry is deemed necessary," so that the first part of Section 11 would read: "When a medical examiner has notice that there has been found, or is lying within his county, the dead body of a person *into the cause and manner of whose death a medical inquiry is deemed necessary*, he shall forthwith repair, etc."

This change would sufficiently enlarge the medical examiner's jurisdiction to include all possible emergencies, without, in my belief, opening the door to abuse. It would take off the implied inhibition which now hampers some of our best examiners; and it would express what is really the practice of others of our leading men.

The only question in my mind is whether a change is either necessary or expedient. Personally, I am not hampered by the present statute, for I go whenever and wherever I am called within my district, always assuming, in the absence of information to the contrary immediately available, that a medical inquiry into the cause and manner of the reported death is deemed necessary. And I feel sure that the same "discretion" in the way of executing this statute would be approved, whoever the examiner was. In this matter, I think Dr. Mead's position is correct, although a strict interpretation of the law is clearly against it; but, on the other hand, if a *strict* interpretation of the law is insisted on, and every medical examiner before he answers a call, must run around the county hunting for that "supposition" of "violence" in the case, as a condition precedent to his official action, he and his law will become absurd. As I see things now, I don't very much care whether the door of opportunity for action under the statute is opened more widely, and I shall keep on answering calls, as I have done in the past, without a preliminary cross-examination of the motives of the person who does the act of calling me. In other words, I think we may say of the medical examiner, when he is summoned to a case:

His not to reason why;
His not to make reply;
His but to get there, spry!
And take charge of the body.

Yours very truly, ——— ———

DISCUSSION.

DR. HOUGH, of New Bedford, said that it might happen, now and then, that medical examiners went beyond the letter of the law in order to comply with its spirit. He deprecated any attempt to alter the statutes — they were well enough at present. If authority was extended in the direction suggested, the county commissioners would naturally object to the larger account for autopsy fees, which such an extension would create. Moreover, the legislators when asked to amend the law would inquire if the change was not designed for the very purpose of permitting more autopsies and so of receiving larger fees. He felt sure that, in all necessary cases, medical examiners were not hampered under the present conditions imposed by law, and he saw some danger in any attempt to make a change. He objected to the proposed method of amendment because it left in doubt the question of emolument, and suggested that many objections might be removed by giving salaries rather than fees.

DR. DURELL, of Somerville, said that the law now in force was the best in the country concerning inquests; and, in his opinion, it would be unwise to meddle with it. It would be difficult to formulate a statute to cover all contingencies, and he hoped no attempt would be made in that direction.

DR. E. P. HURD, of Newburyport, said: I am not in favor of any radical changes in the law pertaining to medical examiners. If the medical examiner feels that an autopsy is called for, he can obtain the authority either from the mayor or chairman of the board of selectmen or from the district attorney. In a case of my own, the appeal was made from the mayor to the district attorney (the former official seeing no sufficient cause for a post-mortem) and the request was willingly granted.

DR. DOLAN, of Fall River: I like very much the change in the wording as suggested by Dr. Adams. As the statute now stands we are obliged to ascribe "supposed to have come to death by violence" to every case investigated, whether due to criminal violence, or to natural causes, or to violence where there is no criminality. The proposed change, while not enlarging in any sense the present duties of the medical examiner, covers more effectually those cases which now come under his notice. I also agree heartily with the reader of the paper in his wish that more autopsies could be held. There is scarcely an autopsy that does not teach some lesson of value to the medical examiner and, consequently, to the Commonwealth.

The reports of the medical examiners for the year 1892, show that in Suffolk County, the ratio of autopsies to views was about one to four, while in all the other counties of the Commonwealth, the ratio was only one to thirteen. It cannot be said that the medical examiners of Suffolk are interested, financially, in the number of autopsies, as, receiving a stated salary, it is immaterial from that standpoint, whether they make one, or a thousand, yet with the rest of us, it is not how many we can make, but how few, for fear of arousing a suspicion, in making many, that we do so from a monetary standpoint.

Speaking editorially of this matter, Dr. Harris in the "Fifty-first Registration Report for 1892," says "the experience gained from frequent autopsies, and the better qualification of the medical examiner thus resulting should far outweigh any expense attending an autopsy." I would like very much to see some way instituted by which we could have the same freedom in making autopsies as our Boston brethren, without being subjected to the aforesaid suspicion.

WAS IT MURDER OR SUICIDE?[1]

BY E. P. HURD, M.D., OF NEWBURYPORT,
Medical Examiner.

On the morning of July 20, 1894, an empty boat was seen on the flats near Carr Island, opposite Jefferson Street, Newburyport. Its oars and anchor were missing. In the bottom of the boat, lying loose, were two boards which had served as seats. A straw hat, evidently the property of an adult man, was the only other thing which was found aboard. The boat was subsequently identified as the property of a resident of Amesbury, who had left it at Black Rocks near the mouth of the Merrimac the day before. The oars and sail had been removed by him and locked up ashore. When the owner recovered his boat, he found, as before mentioned, that the anchor and about seven feet of rope were missing. On the morning of the 28th of July, as two fishermen of the South End were going to their clam-beds, they saw in shallow water, the tide being low, the back of a man protruding above the surface of the water. This was at the edge of Hook's Channel, and the place where the body was discovered is nearly dry at low tide. They rowed up to the body, and found around its neck a rope about seven feet long attached to which was a boat anchor, weighing about nine pounds. The anchor was imbedded in the mud, but had not caught. The body was lying with the face downward and had evidently been in the water several days, being badly swollen and discolored. The fishermen took the anchor into their boat and towed the body to one of the lower landings, where it was examined by me.

On the person of the dead man were two dime novels, which suggested an expectation of some leisure time, and papers which proved beyond a doubt that he was C. F. A., of Haverhill, and also that he was a printer by trade. The body was that of a very large man, five feet ten inches high, weighing about 180 pounds. He was well dressed in a light-gray summer suit and a new pair of laced boots. No hat, no purse, no money, no watch, was on his person.

The remains were in a state of rapidly advancing putrefaction. The face was swollen and the features distorted. A frothy, sanious fluid ran from the mouth. The epidermis was livid, in spots green. The veins of the face and temples were engorged. The abdomen was enormously swollen (cadaveric tympanites); the thorax was livid, greenish, the epidermis in places peeling. A tight rope, with anchor attached, was around the neck; the knot was at the back part of the neck, and examination proved it to be a slip-noose. The knot seemed to be drawn very tight; there was a deep, wide crease around the neck

[1] Read at a stated meeting of the Society, October 3, 1894.

where the rope had constricted the parts. Above and below this crease, the integument was swollen and overlapped. The knot seemed to me drawn tighter than any man could have drawn it himself with his hands above his head, pulling upwards; it was tight enough certainly to produce strangulation. I may say, however, that the deceased was a large, muscular man, that a strong, nervous pull on the slip-noose thus adjusted would draw it pretty tight; and it is a perfectly defensible proposition that any strong man could thus inflict dangerous strangulation upon himself if he were disposed. It is the improbable that often happens.

There were no marks of violence on the person of the deceased other than those inflicted by the rope around his neck; no wounds, contusions, or fractures. A post-mortem examination subsequently made certainly favored the hypothesis of death by strangulation. There was no water in the lungs or stomach, nor in the pleural cavities. The right side of the heart was distended by dark blood; the left side was empty. The lungs were collapsed. Their bases were engorged with dark blood; the upper portions crepitated well on pressure. On section a frothy, sanious fluid exuded; the same fluid was found in the bronchi. There was intense lividity and swelling of the face, lips, hands, eyelids and scalp, with dark veins very prominent; the eyes were red and protruding, the tongue swollen and protruding. The mark of the rope around the neck, four days after the discovery of the body, was very pronounced. The brain, on account of the advanced decomposition, was not examined.

The epidermis of the feet and legs was of a livid, greenish color, and was macerated owing to long lying in the water. The blood was everywhere fluid, and was oozing in places, as on the thorax, owing to the cracks in the skin.

The day of its discovery, the body was identified by his guardian and by a sister as belonging to C. F. A., of Haverhill, a young man twenty years of age, who had left his home on the morning of the 19th, and had not since been heard from. Careful examination revealed the fact that young A. was of dissipated habits. This opinion I had previously formed by a perusal of a diary found in his possession. He had kept very low company; had had intimate relations with a certain disreputable female, and there was infatuation and deep jealousy. This fact I learned of the chief of police. For several days prior to his disappearance he had acted strangely; had been moody, dejected, and had been heard to say that he wished himself dead. There had been a quarrel with his mistress.

A. never carried much money on his person; in fact, he was earning but moderate wages at his trade. There was no means of knowing how much money he had when he left home on the 18th or 19th of July, but the amount could not have been large. His guardian stated that A. had drawn on him the day before his disappearance for ten dollars. What became of this sum the detective who undertook to work up the case was unable to determine. Certain it was, that there was no pocket-book and no money on A.'s person when the body was found on the morning of the 28th.

The owner of the boat found it on the morning of the 20th at Carr Island,

as before stated. The rope and anchor found around the neck of A. were identified as belonging to the boat. The hat was A.'s hat. The boat had been anchored the day before at Black Rocks, near the mouth of the river. The sail and oars had been removed so that the boat might not be stolen.

We are now able to reconstruct a portion of this history. A. had wandered away from Haverhill on or about the 19th of July, and found himself at Black Rocks, a little retired landing, with about four houses a little distance from the water's edge. The presumption is that he came down in the electric-car. He was seen by no one on the way; no one remembers to have seen him from the time he left Haverhill till he arrived at Black Rocks. He was observed at Black Rocks on the evening of the 19th by two rather suspicious characters, one of whom had served a short sentence in jail; this is according to the testimony of these parties, elicited by a detective. Yet these men deny having had any conversation with A. It was impossible to find a shred of evidence to connect either of them with the disappearance of A., though some hope was at first entertained by the detectives that a clue might be found here.

How did A. get to Hook's Channel where his body was found? That boat moored by its owner at the Black Rocks' landing, must have borne the body of A. on the night of the 19th to the place near Hook's Channel where it was found on the morning of the 28th. Did it bear him alive, or did it bear him a corpse? This is the question that is still unsolved.

One theory, entertained by many, is that A. was the victim of a foul murder. At Black Rocks he fell in with one or more desperadoes who, for money, or for some other motive, murdered him. He may have been lassoed, as the Thugs strangle their victims; he was then robbed of what little money he had. The murderers found that they had a corpse to get rid of; there was only one boat there (as was the fact) and this boat was without oars. However, there was no other means of covering up their guilt; they hastily, under cover of the darkness, threw the body into the boat and paddled up the river with the seats of the boat (there were two of them) for oars. The tide was then setting strongly toward Newburyport; and if the boat had been left to the action of the tide alone, it would not have drifted out to where it was found, namely, at Hook's Channel. This is absolutely certain if we can rely on the testimony of all competent boatmen. Consequently, to reach Hook's Channel, the boat must have been paddled considerably out of the current. There was doubtless a good reason why the murderers of A. (if this deed were really a homicide) preferred to row out of the main current — they would thus avoid any small boats which might be passing up or down the river. Hook's Channel was some distance to the left of the main current and boatmen would naturally keep away from that quarter, especially as it was shallow water in that direction. The theory then is that the supposed murderers, after paddling the boat with their dead body out to Hook's Channel, dumped the body overboard, first taking the precaution, by tying the anchor-rope about his neck with the anchor attached, that the body should never rise to the surface and tell of their crime. There is nothing inherently improbable in the supposition that this same rope

was the instrument by which the murderous deed was accomplished in the first place. In favor of the theory of murder is the fact that the deceased when found had no knife in his possession with which the anchor-rope could have been cut. Detective Hammond, however, makes light of this objection, for he has ascertained that A. was in the habit of carrying a pocket-knife with a large blade; this he might have flung into the river after cutting the rope. Another fact in favor of the murder theory is the absence of any money on the person of A. when found.

The subsequent course of our supposed murderers is easily imagined. They paddled their boat over to the Newburyport side, landing on Joppa Flats, then left it there and went their way unobserved and unsuspected. If they imagined that the place where they dumped their victim was deep water, subsequent developments revealed their mistake.

As for the boat, it might readily drift on the ascending tide from the place where it was left, to Carr Island, the other side of the river. This is conceded by the boatmen of Joppa and by others well acquainted with the river. On asking several of the river boatmen whether an empty boat which had been abandoned at Hook's Channel, where the dead body was found, would naturally float on the tide to Carr Island, I could not find one who believed that a boat would be likely to drift in that direction, but all admitted that the course of such a boat would depend somewhat on the wind. It does not seem to me improbable that a boat might drift with the tide from that locality to Carr Island.

Against the homicide theory are (1) the want of any known motive for the murder; (2) the absence of any marks of violence on the person of the dead man other than those caused by the rope; (3) the absence of any clue to the murderer. Moreover, in favor of the suicide theory are the following considerations: (1) The testimony of A.'s employer and of his friends that he had been acting strangely, had been moody and taciturn; (2) that he seemed to have "skulked" away to Black Rocks (fifteen miles), not mingling with any company, and keeping his plans to himself; (3) the place where the Amesbury man's boat was left moored was a retired place — and a man who was meditating suicide would naturally seek such a place. In brief, we can easily imagine such a succession of events as these: In a state of melancholy, perhaps even of mental aberration, A. strays to Black Rocks. He is meditating suicide, and finds the boat. The tide is flowing upward; he raises the anchor, and enters the boat. He is soon out in the midst of the current, drifting upward toward Newburyport. He shrinks from meeting other boats or being seen; he is determined to bury himself from all eyes and to do it so effectually that no one will ever know what has become of him. Especially is the thought gratifying to him that *she* who has caused him so many woes, whom he has so adored, but who has been false to him — that *she* will wonder what has become of him, will miss him, will perhaps some time long for him, but will never, never know his fate. The tide carries him towards Newburyport; he seizes the board on which he had been sitting and sculls to the left. There is

a broad plane of ebbing waters in the direction of the clam-flats; it is quiet and retired out there; the water seems deep; here is a good place to carry out the cherished design. Choosing what he thought a suitable place, he is about to cast himself overboard, when he remembers that he has heard that after a certain time bodies rise to the surface. This thought is abhorrent to him; he wishes to make his fate forever a mystery. He looks around for a weight; he sees the anchor, cuts the rope, throwing away the knife which he will never need again; he may have done the same thing by his pocketbook. It is the work of only a few moments to adjust the slip-noose to his neck; in his frenzy he gives a strong, impetuous tug with both hands on the rope, which, with the anchor, is now at arm's length above his head, and falls overboard. The anchor drags him to the bottom; the constriction of the gullet and windpipe by the rope precludes the entrance of water into the lungs and stomach, and fatal asphyxia soon sets in.

On the whole, I think the hypothesis of homicide the more probable. My first impression when I saw that man on the wharf with the noose so tightly drawn around his neck — *This must have been murder* — will probably yet be verified, if the old adage, "Murder will out," be true. Had A. designed to commit suicide he would have been satisfied with attaching the anchor rather loosely to his person, the object being only to keep the body from rising. Then again, the post-mortem findings certainly favored the hypothesis of death by strangulation rather than by drowning. And yet I am aware that persons have died from drowning without swallowing a drop of water, owing to sudden constriction and closure of the glottis. There are, I believe, no absolutely reliable pathognomonic signs of death from drowning.

DISCUSSION.

DR. HOUGH: I should like to ask what the condition of the kidneys was.

DR. HURD: The kidneys were not examined. The body was in a state of decomposition. It had been taken from the receiving tomb on a very hot day. The examination was necessarily rather superficial.

DR. HOUGH: Were there any subconjunctival ecchymoses?

DR. HURD: I think there were. The intense lividity, the swelling of the tissues about the face and head struck me principally, and the impression was very strong that this was a case of strangulation rather than of drowning.

I would like to inquire if any members present at autopsies of persons who died from drowning have ever found water in the stomach or lungs which they thought was the result of swallowing or inhaling water while the person was in the act of drowning?

DR. HOUGH: I have notes of somewhere in the neighborhood of fifty autopsies on the bodies of persons supposed to have been drowned, wherein I concluded that they had been drowned, and to generalize somewhat broadly, the results of the autopsies are these: that in every case there is water either in the lungs or in the pleural cavity, depending upon the length of time that has elapsed since death. In the first twenty-four or forty-eight hours after

drowning, the water, in my experience, is entirely in the lungs, and they are uniformly so full of water that if you take such a lung and squeeze it, it will run out like water from a sponge that is very wet. Frequently, in fact as a rule, when you remove such a lung from the chest and make a section without squeezing the lung, letting it lie flat on the table or holding it gently in the hand, a stream of water will run from the cut surfaces of the bronchi. After a length of time which I am not able to give precisely, but certainly by the end of a week the water will almost all have left the lungs and passed into the pleural cavity. At the end of a week one finds generally in the neighborhood of a pint of bloody-looking water in each pleural cavity, and I have been led to consider the presence of this liquid in the pleural cavity positive evidence of drowning, in the absence, of course, of any indications of inflammation. The presence of water in the stomach and upper part of the small intestine I cannot attach any value to at all, because so frequently there are the remains of food and of drink in the stomach; so that I cannot tell whether the liquid therein present has been swallowed in the act of drowning, or swallowed before the person went into the water. I usually find the kidneys dark, congested, looking like the kidneys in cases of advanced heart disease. The subpleural and subconjunctival ecchymoses I have not observed in cases of drowning.

DR. DOLAN: The experience of Dr. Hough is almost identical with that of my own. In one case in particular, that had been in the water a week, I found, I think, not a tablespoonful of water in the lungs, but in each pleural cavity about one and a half pints, and in the stomach fully a pint of water, brackish and having the odor of salt water, in which the person was drowned.

DR. PRESBREY: It occurred to me that the statement that there was bloody ooze coming from the mouth and nose would have some importance as evidence in the question of death from drowning. I have been led to feel that it had something to do with it, and mostly in cases of drowning it has been present. If the body has been where there is a rapid current, and has been some time in the water, it may have been all washed away. No mention has been made of the goose-flesh on the extremities. I have been led to think that that was worthy of consideration. Of course the differentiation of death by strangulation and drowning is not altogether easy because they come so near being deaths from the same cause. The matter of finding water in the stomach I have not had much experience with. I should not have salt water to help me. There is on record in our reports one case of drowning in eight ounces of water in a basin, in which there was bubbling water in the bronchial tubes, of course not in great quantity. This point I have mentioned seemed to me of some service in the differentiation as to whether or not the case be one of drowning. It has been my lot once to be called in my district, but out of my city, to a case that was found by the side of a railroad on a hill, on high land. It was in March. The man was wholly unknown, not identified, and no one knew anything about him. All we had to go by was the autopsy, and by the autopsy, considering the points that are generally brought forward and which

have been brought forward here, I was convinced as far as one could be convinced, that the man was drowned, and made that report to the selectmen; and they said it was impossible, because he was found upon high land and not near water. A more careful investigation disclosed the fact that he was found lying upon the face, a little rim of ice above the nose where the water had frozen as he lay there. During a thaw there was a little run of water and the man fell into it and probably was drowned and that rather justified me and I think justified the selectmen in believing me. They next asked me how it could be that this man, who was vigorous in every appearance, without wound or injury, should lie with his face in the water and be drowned. I did not know. I said: "Possibly the man was intoxicated, or possibly he might have been an epileptic and fallen there in an epileptic fit." The case was reported for inquest because of its blindness. The day before the inquest the man was identified by his brother, and I asked the judge if he would inquire of this man whether his brother was ever known to have epilepsy. The brother said he was a confirmed epileptic. There was a case in which the diagnosis was really made upon the phenomena that showed themselves in a body that died from drowning.

THE MURDER OF JAMES FARRAR.

BY JULIAN A. MEAD, M.D., OF WATERTOWN,
Medical Examiner.

At half-past two in the morning of May 17, 1894, James Farrar, a farmer in the town of Lincoln, was awakened by a burglar who left the room as soon as he saw that Mr. Farrar was awake. Mr. Farrar rose immediately, dressed, and aroused a man who lived in his house, and then called up four other men who lived in the neighborhood.

In the meantime, a window in the kitchen of James Farrar's house was found open, and under this window was a peculiar foot-print pointing toward the house. Similar foot-prints leading to and from the house were found in the dusty road. For some time the peace of the town of Lincoln had been greatly disturbed by several burglaries, and James Farrar, who was a constable, considered it his duty to arrest the man who had broken into his house. Together with four companions, he followed these peculiar foot-prints, now plain, now obscure, now leading up a side road, or into the yard of some house, but always onward toward the town of Weston. When they reached the Tower Hill station of the Massachusetts Central Railroad, which is about four miles from Mr. Farrar's house, they lost track of the peculiar foot-print that they had followed so persistently. At this point the party separated; James and his brother Edward went down the track, and the other three drove in the carriage around to the Cherry Brook railroad-crossing, which is some distance nearer Boston.

James and Edward, encouraged by finding a single foot-print on a sleeper, pressed steadily on down the track, and soon descried in the distance a moving object which, in the dim, uncertain light of dawn, seemed to be a man. This object at once disappeared around a curve in the track, and, when the Farrars reached the spot, was nowhere to be seen. They heard, however, at this time a noise like the breaking of branches in the woods at the side of the track. They went into the woods, and found a man standing at a freshly-kindled fire. After some talk of the danger of building a fire in the woods, they put the fire out, and asked the man to come with them; but this he refused to do. James then said, "We intend you no harm, but you must come with us." The man, who subsequently gave his name as Barrett, pulled out a revolver, covered the Farrars, and said that he would not go with them. He then went toward the railroad track, pointing the revolver at them as they slowly followed him. On reaching the track, he started down towards Cherry Brook crossing, keeping his pursuers all the time covered with his revolver. Barrett had not gone far

when he saw the rest of the party, who had gone around the highway, coming up the track towards him. His retreat being cut off in this direction, he ran up the bank on the opposite side of the railroad. James Farrar rapidly followed him, and reached the bank soon after Barrett, whose retreat was cut off by a barbed-wire fence. Barrett, cornered and at bay, began to fire at James who reached him just as he fired the third shot. James sprang upon Barrett, and with the help of his brother Edward, soon had him on the ground. In a few minutes James said, "I am shot." He then fell over and died.

I found the body dressed in a leather jacket, woollen vest, two thin shirts, trousers and shoes. In about the centre of the breast of the leather jacket there was a black spot and a ragged hole. There was also a corresponding hole in the vest and shirts. At the back there was a hole in the shirts and vest, but none in the leather jacket. A bullet was found between the back of the vest and the leather jacket.

On the following day I made an autopsy, assisted by Drs. Wood and Jackson. There was a black spot in the middle of the front of the chest, two inches long and three inches wide; in the centre of this spot was a circular hole that measured one-quarter of an inch in diameter. This hole was an inch above a line drawn between the two nipples. The upper part of the left side of the face, and the left ear were sprinkled with black spots (powder-marks).

On dissection, a small hole, corresponding to the hole already described in the skin, was found in the sternum, just opposite to and near the upper border of the third rib on the left side. The under side of the sternum presented a ragged hole about an inch long pointing toward the left.

The left pleural cavity contained two litres of blood. The left lung was collapsed.

The path of the bullet could be traced by a dark blue line along the upper border of the upper lobe of the left lung, which was slightly wounded at one point. This line led to the left common carotid artery, which was found to be nicked.

There was a small irregular hole, from which blood was slowly oozing, on the left side of the back at a point three inches from the spinal column, and two and one-quarter inches above the spine of the left scapula.

All other organs were found normal.

The cause of death was hemorrhage from the left common carotid artery.

Barrett was indicted for murder by the grand jury, and was tried at Cambridge on the 19th of November, 1894. The trial was ably conducted by Attorney-General Knowlton and District-Attorney Wier for the Commonwealth, and Messrs. Goodrich and Selfridge for the defendant.

The defence tried to prove that Barrett did not know that he was being arrested for burglary, or that James Farrar was a constable, and that, therefore, he acted in self-defence. In order to strengthen this theory of self-defence, Barrett's lawyers tried to prove that he, instead of deliberately firing three shots, as testified to by eye-witnesses, fired but one shot, which was discharged more or less accidentally, after Farrar had seized Barrett. The defence main-

tained, therefore, that the ball entered the breast at an angle of forty-five degrees, and that the powder-marks on the left ear, and upper part of the left cheek were made by the powder that discharged the fatal bullet that entered the chest.

The medical experts for the Commonwealth, Dr. Draper and myself, testified that the bullet entered the breast at right angles, and was deflected in its course by the sternum. We were led to this conclusion by the fact that the hole in the skin and sternum was perfectly round. We also testified that the wound in the chest, and the powder-marks on the ear and cheek could not have been made by one and the same shot.

In support of our opinion, we undertook, by experiments, to reproduce as far as possible the position of the revolver when the shots were fired. Using Barrett's revolver and the same kind of cartridges, we fired, at different distances, into an old leather jacket which closely resembled that worn by Farrar on the morning of the murder, until we obtained a hole that corresponded to that in Farrar's jacket. To obtain this similarity in appearance it was necessary to hold the revolver about an inch from the jacket. It was conceded by the defence that this distance was correct.

We determined the distance at which the revolver was held, when the shot was fired that made the powder-marks on the ear and upper part of the cheek, by firing at pieces of blotting-paper, and noting the result. The first shot was fired at a distance of eight feet and left no powder-marks on the paper; at seven feet there were a few marks; at five and six feet the marks were somewhat increased but still quite scattering; at four feet the spots were quite thick; at three feet and a half they corresponded in appearance to those seen on the ear and cheek at the autopsy; at two feet they were very thick, and nearly covered the centre of the paper.

These experiments show conclusively, I think, that the revolver was between three and four feet from the face when the powder-marks were made. Is it possible to reproduce the picture more completely by showing how near the head the bullet passed? You will notice on the blotting-paper targets that the powder-marks are not visible to any extent at a distance of more than four inches from the hole made by the bullet. The bullet could not, therefore, have gone further from the head than four inches, and the number of powder-marks in Farrar's face show that it must have gone as near as three inches, and perhaps a little nearer.

These experiments demonstrate beyond a doubt that the revolver was not farther than an inch from the chest when the fatal shot was fired, and that it must have been three or four feet from the face when the powder-marks were made.

If it is not already clear that separate shots are necessary to produce these two appearances, we have further experiments to show the impossibility of one shot causing both the wound in the chest and the powder-marks.

Experiments were made to see how far from the wound, made by a revolver bullet, powder-marks are visible. At about an inch, the distance at which the

wound in the chest was made, there was no spattering of powder, but simply a smutting around the hole; at three inches the result was much the same; at six inches the smutting was present, and some grains of powder were visible; at twelve inches the smutting began to disappear, and the powder-marks were abundant; at twenty-four inches the smutting entirely disappeared. In none of these experiments did the powder-marks appear to any extent beyond a distance of four inches from the bullet-hole. This held true in angular as well as in direct shots.

To substantiate their theory the defence must prove that powder-marks can be deposited one foot from the bullet-hole when the revolver is held about an inch from the wound.

These experiments prove that such spreading of powder is impossible with modern powder and revolvers.

There were, in this particular case, certain additional facts that make the ground of the defence untenable. You will have noticed that no mention has been made of powder-marks on the chin or neck or lower part of the cheek. There were none. Moreover, Professor Wood, after a careful microscopical examination of the jacket above the bullet-hole, was unable to find any grains of powder.

Drs. F. A. Harris and Charles Hebbert testified for the defence that the circular hole in the skin was no criterion whatever as to the angle at which the bullet entered the body. Dr. Hebbert admitted on cross-examination that if the hole in the sternum was circular, the bullet must have gone in straight. Dr. Harris was not asked his opinion on this point.

Both Drs. Harris and Hebbert were asked if a pistol-shot could make a circular wound at the junction of the third rib with the sternum, and at the same time scatter powder-marks on the left ear. To this question they both answered, "Yes."

We now come to the consideration of the statement made by the defendant's medical experts, Drs. Harris and Hebbert, "that the condition of a bullet-wound in the skin, as to its being round or oval, is no criterion as to the angle at which the bullet was discharged."

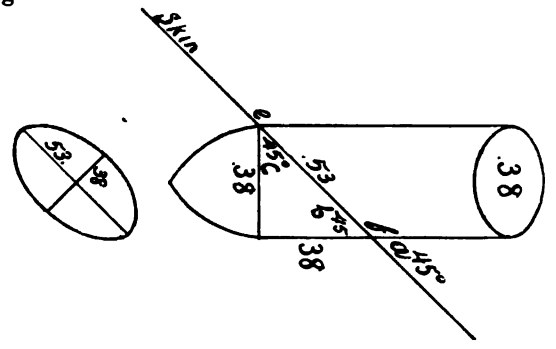
The additional circular hole in Farrar's sternum makes this point of little importance in this case, but the general question is well worth some special attention. Since the trial, Captain Gibson, of the Ordnance Department, U. S. A., and I have made some investigations on this subject.

The question is, Does a bullet entering the surface of the human body obliquely make an absolutely circular wound? It is not doubted that bullets fired point blank and at a little distance may turn to such a degree as to make an oval or irregular wound.

In answer to the above question both the experts for the defence testified that a bullet fired obliquely often makes an absolutely circular opening. Dr. Hebbert said that this was true because the skin, being an elastic and contractile tissue, contracts after an injury, and assumes more or less the shape of the object which caused the wound.

We may admit the truth of his reason without subscribing to his conclusion; and, if it can be shown that the form of a bullet entering the skin at an angle is elliptical and not circular, he must necessarily change his conclusion.

Let us now see what is the shape of a bullet's cross-section as it enters the skin at an angle.



The figure represents a thirty-eight calibre bullet entering the skin at an angle of forty-five degrees.

The problem is to find the length of the line *e f*. We know that the angle *a* is forty-five degrees, and that the base of the right-angle triangle is thirty-eight, the diameter of the bullet. It follows then that the angles *a* and *b* are both forty-five degrees, and that the perpendicular is also thirty-eight. By extracting the square root of the sums of the squares of the other two sides, we find that the line *e f* is fifty-three. This shows that the form of the wound is an ellipse whose major axis is fifty-three, and minor axis is thirty-eight.

Now, if the skin contracts after the bullet enters, as it undoubtedly does, it is absurd to say that it contracts in only one diameter. It is more reasonable to suppose that there is a general contraction, and that the size, and not the form of the opening, is changed.

To see if this theory holds true in practice, we fired at an angle into various objects, such as chamois skin, cloth and paper, and found that the opening was always elliptical. As none of these things have the elastic principle of the skin, we chloroformed, and fired shots into, a dog. We found that while the elasticity of the skin made the ellipse somewhat less marked, the elliptical form, in different degrees, was present in all the angular shots, and absent in the direct shots. There was always a bevelling of the skin at that part of the wound nearest the point from which the shot was fired.

I have been unable to find much on this subject in the authorities. Taylor says that "the aperture is round only when the bullet strikes point-blank, or nearly so. If it should strike obliquely, the orifice will have more or less of an oval or valvular form."

Roswell Park, in Witthaus and Becker's new work, states the matter much the same as Taylor does.

Capt. Louis La Garde, of the Medical Department, U. S. A., conducted a series of experiments on the cadaver to determine the difference in destructive

effects between the projectiles of large and small calibre from hand rifles. He writes me that bevelling in the track of the projectile would indicate that the piece had been held at an acute angle with the plane of the part hit; and an absolutely circular opening without bevelling should indicate that the projectile had entered when its line of flight was at right angles to the point hit.

It seems clear that the experts for the defence were not justified in asserting that the form of the entrance wound of the bullet is "absolutely no criterion" of the angle at which the shot was fired; or that an oblique shot often makes a perfectly circular opening.

Barrett was convicted of murder in the second degree, and was sentenced to the State Prison for life.

DISCUSSION.

DR. ABBOTT: The whole paper is an extremely interesting and very clear statement of the subject and a correct one. I was thinking as the doctor sat down, that his point could be illustrated still further by exaggerating the angle and bringing the line of fire nearer to the line of the skin, making a very acute angle; if the pistol is held within five or ten degrees instead of forty-five degrees it will make a longitudinal line, ploughing out the skin and then passing through it; and if it is true of five or ten degrees it ought to be of forty-five or even seventy degrees, the long axis of the opening being proportioned to the acuteness of the line of fire compared with the plane of the skin.

DR. MEAD: I took that angle because that was the angle the defence said the bullet must have entered, and it was to show the general fact that the shape of the bullet-hole at an angle of forty-five degrees was an ellipse and not circular. What Dr. Abbott says is very true, and theoretically the problem is a pretty one, because given any one of those lines you may theoretically determine at just what angle the shot was fired, given the appearance of the wound.

If you have the hypothenuse and base of that right-angle triangle you can easily find the angle. In that case, knowing the angle and the base, we found the hypothenuse.

DR. QUIMBY: I have noticed in cases of suicide in which the weapon was naturally supposed to be in close contact with the skin the absence of powder-marks. It must be held at some little distance before the powder-marks will be visible, it being merely a smutting at close range.

DR. JOHNSON: I did not hear the paper, but I would like to ask whether, in consideration of the direction the wound would take, the matter was considered of the nature of substructures, as to the condition of the muscles, the elasticity, what might underlie the skin at the time, and whether or not that would affect the result?

DR. ADAMS: In this case it could hardly affect the result inasmuch as the wound was at the junction of the ribs with the sternum; the muscles could hardly enter in.

DR. HARTWELL: I have been very much interested in Dr. Mead's paper. I am sure what he gave us will prove of very great benefit as a practical investigation of this mooted question. It was certainly very unfortunate in that

trial to have the matter commented upon in the public press, that a medical examiner in this State appeared on the part of the defence; and of course we all regretted it. We remember, Mr. President, the very able paper of the medical examiner from Amherst, in relation to the position the powder-marks take as regards the hole in the flesh, showing, if I remember, that they are at quite a distance from it, that is, the point of greatest showing of the powder-mark is toward the hammer side of the weapon and above the point of entrance of the bullet, if I remember correctly. In these experiments of Dr. Mead's, this shows very plainly. Members of the Society living in Middlesex County are interested in that case, and points are illustrated which we did not comprehend through the press.

I am sure we should all like to hear the President's greater experience on this point.

DR. ADAMS: I am sorry, gentlemen, that I must disappoint you in giving you no evidence whatever in regard to this special point. The wounds received in battle are received from a distance, and in the great majority, of course, the bullet is turned in the air or has in some way or other altered its form before striking the body, so that there is nothing about the wound to indicate the precise direction from which it came. As to wounds given near at hand I have very little to say. My experience is small in regard to gunshot wounds at close range. I have drawn no conclusion from my own observations in regard to this matter of the form of the wound as indicating the angle at which the weapon was held. With regard to the matter of the spattering of powder, it is a very curious fact that the pistol must be held at some distance to show powder-marks. If held very near it burns. It must be held at least a distance of a foot to make any powder-marks. Anything under a foot, you won't get powder-marks I think. With regard to Dr. Hartwell's statement that the powder-marks are found above the wound, that was the fact, I believe, in the only case I have in mind. The powder-marks were on one side of the wound only and that the upper side. It would be well to remember this fact.

DR. MEAD: I should like to say of that point Dr. Fish made, I think it was this: that the extra brand was always to be found on the part of the wound that corresponds to the hammer. The chief brand would be above; fired with the hammer down, the brand would be below. Hold the pistol so that the brand would be opposite the hammer, and one can tell how the pistol was held at the time of firing.

DR. HARTWELL: That was the point. It is a very important one as showing the manner in which the weapon is held. Dr. Fish did not give any explanation of it as I remember.

DR. GILBERT: In two cases I have found the marks of the powder above the point where the bullet struck. I made some experiments with a pistol with a view of ascertaining how far the powder marks would show and whether they would show above or all around the point where the bullet struck. They invariably showed above, that is, on the same side of the bullet-mark as the cock of the pistol was when fired; and I attributed it to the rebound when you

fire; the bullet goes first with the rebound; the pistol always comes up towards the cock, and the powder-marks are in that direction from the mark of the bullet, the handle of the pistol acting as a lever.

DR. HARTWELL: It would seem to me that if there was a rebound or kick in the direction of the hammer the bullet ought to take that direction. I do not remember the point Dr. Fish made in his article. I cannot explain it. It seems to me the powder leaves the chamber as soon as the bullet at least, and if there is a kick, why should not the bullet go in that direction too? The probable solution is that there is a rebound, or kick, by the barrel toward the hammer side, and that the difference in the character of the bullet and the flash determines the greater deflection of the latter.

DR. MEAD: In the cross-examination of Dr. Hebbert, his point was that the bullet entered here [pointing to his chest] and the powder went up here [pointing to his ear]. The attorney-general drew out his theory, which was that the bullet went first and the pistol kicked up and the powder went up here; quite a lapse of time between the coming out of the bullet and the powder.

DR. ADAMS: If I were to state my own opinion about this, I believe there is some defect in the observations here. More careful observations will show the reason clearly enough.

DR. JOHNSON: It seems to me it is owing to the shape of the pistol and the leverage; where the pistol is pointing up the powder goes up, if down, down. The interval of time must be extremely small between the leaving of the ball and the escape of the powder, yet there might be opportunity for the powder to get a throw that the ball did not have.

DR. MEAD: If I remember correctly, Dr. Fish continued his experiments by shooting off a revolver in a vice where there could be no recoil, and I cannot recollect the result, but I remember he made that experiment. The paper must be here in the records.

DR. ADAMS: That same experiment would determine this question.

DR. PAINE: I remember Dr. Fish's paper well. He not only tried one revolver, but different firearms at the Springfield Armory, and the result was the same with all first-class revolvers. He has cuts in the "Transactions" which show that. I believe his idea was that the mark of the powder was always in the direction in which the hammer was held, whether upwards, downwards or sideways. A week ago Friday night I was called to see a case of attempted suicide. A young man had shot himself in the forehead, and was alive when I arrived. I found him in bed. At the foot of the bed was a pool of blood; there were also marks around the room where he had put his fingers; blood had dried on the face, and what appeared to be brain-matter was oozing from the wound. I asked the direction of the wound and they said directly inward. The physician in charge wished me to take care of the case, and he has been my patient since. Several years ago he had cerebro-spinal meningitis, after that epilepsy, had been in the Eye and Ear Infirmary as his eyesight was growing poor; from there he went to the Massachusetts General Hospital,

where he was taken insane and was sent to Taunton. Eleven months ago he was taken home. Since then his eyesight has been growing worse, and of late he has been having his epileptic fits, so much so that he got tired of living and said there was nothing to live for. His wife had died just before he became insane. He called on his mother January 23d, and on his way back he stepped into a store on Main Street and bought a revolver. Instead of taking the car which passed his house, he took one which ran directly opposite to his house, got off, went through the woods, sat down on the ground, put his revolver to his mouth and tried twice to fire, and the weapon would not go off. He then came home, and as the car passed the house he walked in to show that he came in that car. Friday afternoon he stepped across to the car-house and got some oil and oiled the revolver, and came home; he was found wounded about six o'clock. Between three and four he went into his room after leaving a note, sat down on the foot of the bed with his back to the bed-post and fired, and was found in bed with the clothes drawn over him, the revolver on the floor. There was a good deal of swelling of the eye. I could not find any blackening of the skin or any marks of powder on the forehead after washing the blood off. The patient is still alive. Now where did the brain-matter come from? The left eye is completely destroyed. I think the bullet lies in back there. The whole orbital plate seems to be fractured. There has been no rise of temperature. He will be totally blind.

Dr. Adams: It is very interesting to know how slight things will sometimes turn the course of the ball after it has penetrated, and what slight things will cause a ball to change its shape. A ball that will strike, for instance, the soft parts alone without so far as is known striking any hard object, will often be materially altered in shape. This I feel quite confident of. I can cite a number of cases where I was sure the ball did not strike any solid substance and yet was found to be very much bent. In a case I had lately (a man shot with a pistol in Natick a few days ago), a very curious fact was found in the direction that the ball took. It was deflected by striking simply the thin plate of bone on the upper part of the petrous portion of the temporal bone, the little rise of bone over the auricular canals, and this apparently deflected the ball to the extent of about twenty degrees. The ball, fired downwards, entering above and behind the ear, going downwards and forwards in the course shown by the probe, would have come out somewhere in the vicinity of the angle of the jaw of the opposite side, but was so deflected by striking this little plate of bone that it came out nearly at the top of the anterior hemisphere. That is, it was so deflected that it was found considerably above and in front of the opposite ear. But there are many cases that I have seen where the ball has been deflected simply by striking the soft parts; and that it is frequently deflected by striking soft parts alone, I am confident.

Dr. Abbott: Speaking of the deflection of balls and the curious lines they will take, reminds me of a statement in McLeod's surgical history of the Crimean War. A man was struck in the front of the trachea, the ball passing around his neck beneath the skin and coming out of the same opening. I be-

lieve that is an authentic case. A member of the Massachusetts Medical Society, Dr. Lucius Manlius Sargent, commander of my own regiment, was shot by a ball that struck him in the chest and followed the rib half way round and came out at the back. He gave himself up as a hopeless case, but came out all right in the course of a few weeks. He was afterwards shot by a shell and killed. It is an instance of the curious directions bullets will sometimes take.

Dr. Mead: On the point of the bullet's entering at forty-five degrees the defence took the ground that the sternum was too soft a bone to deflect the bullet, that it was a spongy bone made up of two plates and the bullet not likely to be deflected by that. The attorney-general asked if flesh alone would not cause a bullet to turn, and Dr. Hebbert did not know what the word "flesh" meant. The main point was that the sternum was too soft to cause deviation in the course of the bullet. Dr. Draper and I thought it was sufficient to cause it.

Dr. Adams: I do not believe there is any part of the human body too soft to deflect a bullet in its course. I believe a bullet does not always pursue a straight course in the brain. I think I have evidence from my own experience to show that the ball changes its course after it enters the brain-substance. You must remember in reaching the brain-substance, the ball striking the bony structures first, is partly bent and broken with its force lessened; then it falls into the brain-substance and moves as it would in water, for example.

Dr. Howe: I would like to inquire whether in those cases in which the ball pursued circuitous courses, the velocity had anything to do with the result, whether they were spent bullets or fired near at hand?

Dr. Adams: If the Chair should express an opinion it would be that that makes not the slightest difference; the speed of the ball does not alter the case, which is that the bullet will be deflected by striking soft substances as well as hard, no matter how swiftly it is sent; I speak of such swiftness as is given to the rifle ball.

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THE POST-MORTEM SIGNS OF DROWNING.[1]

BY G. DE N. HOUGH, M.D., OF NEW BEDFORD,

Medical Examiner.

DROWNING is death in consequence of cutting off the access of air to the respiratory passages by any fluid. Only enough fluid to cover the nostrils and mouth is needed. I found a case reported where a drunken man was drowned in the water contained in the print of a horse's hoof in the mud, and many cases are known of persons being drowned in a gutter or brooklet where the water was not deep enough to cover the ears of a person lying on his face.

By no means all who die in consequence of falling into the water are drowned. Some persons are removed from the water alive, and die after a time from such things as: spasm of the glottis, pneumonia (due to the injury sustained by the lungs from the water that has penetrated them), cholera (a case reported in England of a boy submerged in infected water), or suddenly without apparent cause (supposed to be due to the arrest of interstitial nutrition during the time respiration was suspended). We have, besides these, a certain number of cases in which the death may be due to shock, syncope, paralysis of the heart, tetanic spasm of voluntary muscles and perhaps of the heart itself, inhibition of respiratory movements, cerebral hemorrhage, congestion or concussion, or an epileptic seizure. Such cases cannot be considered as cases of drowning, properly speaking; and while their study is of extreme interest, I must at present pass them over for lack of time.

It must be remembered, however, that often one or more of these disturbances play an accessory part in cases of true drowning; and it is to them, in fresh bodies, that the principal difficulties of the post-mortem diagnosis of drowning are due. The part that they play was formerly considered much more important than at present. The more recent investigators find that by far the largest part of the cases of death in the water are due to asphyxia; and the rôle of syncope, cerebral congestion, neuro-paralysis, etc., seems to be growing less and less important. For example, Dr. S. Coull Mackenzie [2] reports 305 cases of drowning: of these, six were so far advanced in putrefaction that the cause of death could not be determined. Of the 299 remaining, one died of syncope, one of apoplexy and asphyxia, 297 of asphyxia. Other recent writers estimate the proportion of deaths from pure asphyxia at from 80 to 90 per cent. In 50 cases, I have seen but one due to anything but asphyxia. This was a man with mitral valvular disease; no signs of asphyxia

[1] Read at the Annual Meeting, June 11, 1895.
[2] Medico-legal Experience in Calcutta. Edin., 1891.

were present. I presumed that he died of syncope or sudden paralysis of the heart. In true drowning the cause of death is asphyxia.

When a body is found in the water it is natural to infer that death was caused by drowning. This may, however, be an error; and it is our duty to find positive proofs of the mode of death if such proofs really exist.

There is no pathognomonic sign of drowning; yet in most cases the diagnosis is possible, provided the examination be made before putrefaction is too far advanced.

It is impossible to set any exact limit in time for this obliteration of signs, but, roughly, it requires about fifteen or twenty days in winter and from three to eight days in summer. The character of the liquid medium, the presence or absence of currents, the richness of the medium in those bacteria that liquefy gelatine and albuminous substances, all affect the rapidity of putrefaction, and hence the varying length of time during which the signs will persist. Of course, the principal element (as is shown by the figures just given) is the temperature.

I wish to make a special point of the necessity of making our examinations in these cases as soon as possible after the body is taken from the water. Once out of the water putrefaction advances with tremendous speed, and in warm weather a couple of hours will sometimes suffice to render our autopsy worthless.

The special signs of drowning will be less marked the more largely the concomitant or accessory causes of death enter into the case, so that in a large series of cases we find all grades of development of these signs. Again, the signs will vary somewhat according to the rapidity of the death and the number of times the person rose to the surface. If our autopsy for any reason yields negative results, it is well to set forth in our report the reasons therefor, and especially to state that in spite of the absence of characteristic signs of drowning the person may have come to his death in consequence of falling into the water.

In examining a drowned body there are three sets of phenomena that attract our attention: (1) those due merely to the body's lying in the water; (2) those met with in asphyxia from any cause; (3) those found specially in the drowned.

Our conclusion is based on a considerable number of facts. No one of these facts is of itself sufficient. All taken together make the correctness of our conclusion almost positive.

External Examination. — Rigor mortis is of value only in determining the time that has elapsed since death. Parts are involved in the same order as after other modes of death. It usually sets in early because the body cools rapidly, and as in other violent deaths may be instantaneous. Its duration depends partly, at least, upon the temperature to which the body is exposed both before and after removal from the water. The higher the temperature the more rapidly it disappears. Barlerin observed it beginning in the lower jaw after only two or three hours; Belohradsky found it complete and strong

in one case after nineteen hours; Dsirne observed it still existing once after six and once after seven days.

Suggillations are found, as usual, on the most dependent parts, which, in floating bodies, are usually the head and thorax. They are probably not formed prior to four hours after death, and reach their maximum in twelve to fifteen hours. Their abundance depends on the amount and fluidity of the blood. From their situation we may infer the attitude in which the body cooled. Their color is often bright red or rosy-red. This color depends in part upon the effect on the blood of the oxygen dissolved in the water which soaks into the skin, in part upon the fluid condition of the blood, and in part upon the effect of cold upon the body. Such spots were observed by Dsirne abundantly in a case which came to autopsy twelve hours after death, and in small number in a case seven days after death. They were present in 40 out of 48 cases that were not too putrefied to show them. Similar spots are seen after poisoning by prussic acid, by charcoal gas, by illuminating gas, and in any body whose blood is fluid if it lies long enough in the water.

As far as my reading has extended, all authors (save two) agree that the course of putrefaction in bodies that are floating in water differs in a characteristic manner from that in other bodies. This characteristic difference consists in the fact that, while in other bodies putrefactive change first shows itself on the abdomen and progresses both toward the head and toward the feet, in water bodies it begins at the head and progresses gradually toward the lower extremities. The abdomen, indeed, shows the changes so much later than the head and neck, that, if a water body be divided into two parts by a transverse incision at about the level of the second lumbar vertebra and the two parts be viewed separately, one could hardly convince himself that they were derived from the same body. According to Belohradsky and Kornfeld, this peculiar progression is not constant. The case mentioned by Harris was not a body that putrefied while floating. Kornfield says that the changes of putrefaction often follow this same order in cases of death from heart disease. In consequence of putrefaction there is in water bodies a tremendous development of gas in the subcutaneous connective tissue. We do not find this to the same degree in other bodies, except perhaps in cases of emphysematous gangrene of rattlesnake bites.

There is nothing peculiar about the pallor of a drowned body. As Casper says, preconceived notions and the personal equation enter prominently into this question. Rosy patches, due to injection of the vessels, are often seen on the inner surfaces of the thighs and anterior part of the chest of fresh bodies. They are due to the effect of cold. If a body presenting such patches be put in a refrigerator, they become generalized. The same color is often seen on a body immersed post-mortem and then put in a refrigerator. Tourraine and Bédié saw the same red color appear suddenly on the thorax, abdomen and back of some soldiers bathing in cold water.

The skin of any water body will be saturated with water. When on the autopsy table, the rapid evaporation of this water may cause the skin to feel

comparatively cold when one touches it. This is not an important sign, and its appreciation, like that of the pallor of the drowned, depends largely on "preconceived ideas and the personal equation."

Leaving out of consideration young children, in whom it is uncommon, and new-born infants, in whom it never occurs, cutis anserina is almost always present in drowned bodies unless they have been so long in the water that the epidermis has become separated. Usually, it is recognizable for from eight to eleven days after death. It is usually best marked on the anterior surfaces of the extremities, and is most distinct in very hairy persons. It depends partly upon mental shock, and partly upon the sudden plunge into a cold medium. Anatomically it is caused by contraction of the arrectores pili, their relaxation being prevented by rigor mortis. It occurs not only after drowning but also after all sorts of violent deaths, and sometimes during life, and can be produced on a dead body by throwing it, while still warm, into cold water. A condition of skin not distinguishable from this is said by Casper to be very common among the lower classes in Berlin, as a permanent appearance.

Retraction of the penis, scrotum and nipple are phenomena which, like cutis anserina, are produced by contraction of certain smooth muscle-fibres of the skin and subcutaneous connective tissue, the contraction being caused by mental shock or by the sudden effect of the plunge into cold water. They are very common but not invariable signs, and, of course, disappear as the gases of putrefaction develop in the subcutaneous tissue.

The epidermis of any body that lies in the water undergoes certain changes from imbibition; it first becomes whitish and opaque, then swollen and wrinkled, and then gradually separates from the true skin. This process occurs earliest where the epidermis is thickest, and hence, first of all, on the soles of the feet, if they are naked; otherwise, first on the palms of the hands. These parts show distinct change usually in six or eight hours. Dsirne observed distinct bleaching and wrinkling in two hours and in four hours; he found it absent in one case after six hours, in two cases after twenty-four hours, and in one case after eleven days. Next after the hands and feet these changes are usually noticeable at the knees and elbows. In a month the epidermis is almost entirely detached.

The whitish, opaque, swollen and wrinkled appearance of the hands and feet may be produced by prolonged soaking during life, and in the case of the feet may be due to profuse perspiration. One observer alleges that if a body is put into water after death the mode of separation of the epidermis on the hands and feet is not like that seen in the bodies of the drowned. He says that in the former the epidermis becomes cracked and fissured, and rises up in little shreds, while in the drowned it wrinkles longitudinally and separates almost in a single piece like a glove. These observations lack confirmation.

The bluish, livid color of the underlying tissues showing through the more or less macerated epidermis gives to the hands an appearance strikingly different from that of the rest of the body (except the feet). Hands in this condi-

tion are often spoken of as "cholera hands," from their resemblance to those of persons in the cyanotic stage of cholera.

The hair comes off pretty easily after about eight days. That of the head and pubes commonly comes out, roots and all, while the down of the body and all young strong hairs break off at the surface of the epidermis or in the follicles.

The nails become blue or yellowish-red, and are loosened in from seven to fifteen days. They generally fall off (sometimes the epidermis comes off *en masse*, carrying with it the nails) in two or three months.

The eyelids of fresh bodies are usually half open. They become swollen as putrefaction advances, and finally by this change are entirely closed. Sometimes, in children, there are ecchymoses on the lids. The globe of the eye, if the body is fresh, looks like that of a live person, brilliant, smooth and clear. This is what is meant by those authors who speak of the fish-like expression of the eyes of the drowned.

The conjunctivæ are at first usually pale-reddish, with more or less injection in the culs-de-sac; later, corresponding to the cyanosis of the head, they become dark-red, livid, or violet. Ecchymoses of the conjunctiva occur but rarely in adults, much more commonly in children; they are particularly common, according to Hofmann, in those who are drowned in thick fluids.

The sclerotic is more or less edematous, especially at its inferior part if the body has not been long in the water.

On that part of the cornea not covered by the eyelids there may, in fresh bodies, be seen several (twelve to fifteen) gray phlyctenular elevations of the size of a poppy-seed. These elevations disappear after a time, and this part of the cornea looks bright, and is deprived of its epithelium. That part of the cornea that was covered by the lids is cloudy throughout its whole extent, and its epithelial covering somewhat swollen. These peculiarities of the cornea were observed in every one of twelve fresh bodies of strong young persons drowned while bathing. The observations were made in summer. The author says the changes develop more slowly in winter (Seydel, 1890). Dsirne observed the cloudy condition of the cornea nine times; three times in summer, twice in each other season. It was developed in one case in four hours. Dsirne did not observe the phlyctenulæ.

The pupils are usually dilated, often very unequal. Their diameter is commonly from six to eight millimetres. The iris is often more or less reddish, so that the eye resembles that of an albino.

On the dorsal surface of the nose, there are often erosions due to rubbing against the bottom. This is especially common in men, because, owing to the mode of distribution of their adipose tissue, men usually float face downward, while women float face upward. In the women, therefore, we more frequently than in men find foreign substances and effusions of blood or bloody liquid in the nostrils.

At the nostrils and at the mouth we often find a mass of froth. This is of the same character as that found in the air-passages, from which indeed

this comes. It is made up of very small bubbles, is whitish or rosy-red at first, becoming later, in consequence of putrefaction, reddish or brownish. Dr. Draper has well characterized its appearance as like the lather produced by shaving soap. It is not commonly found after a body has been three or four days in the water, and disappears rapidly after removal of the body from the water. It is present in only about 15 to 20 per cent. of the cases of drowning. Sometimes, when not present, it will appear if pressure is made upon the chest. The presence of this froth is of great importance; for it is the only external sign that can be considered of much value from a diagnostic standpoint. True, it is not a pathognomonic sign; nevertheless, we will seldom make an error if we take it for granted that a body, taken from the water, and presenting a mass of fine bubbled, white or rosy froth at the mouth and nostrils, is that of a person who came to his death by drowning.

The lips in recent cases are bluish or cyanosed, and may present erosions or ecchymoses or traces of having been bitten. From putrefaction, they become after a time enormously swollen, blackish and separated, showing the teeth and tongue. At the lips we often find the same froth as at the nostrils. Sometimes it occurs at the lips and not at the nostrils. Foreign substances are sometimes to be observed on the lips or within the mouth.

The position of the tongue is, to be sure, of no diagnostic value, still it is more commonly somewhat pushed forward, and in a certain proportion of cases is between the teeth, by which it may have been indented, contused, or lacerated, and then it is often swollen. The base of the tongue may show a vascular injection, which may be limited to the tongue or may extend also to the epiglottis.

Excoriations or abrasions of the dorsal surfaces and ends of the fingers have been mentioned by nearly every one who has written on drowning since the time of Ambroise Paré. They have been supposed to indicate a struggle for life, and to be due to rubbing on the bottom during this struggle. Many observers of wide experience have rarely, if ever, met with them. They may, if present, have been produced before immersion, and what looks like excoriations may be merely elevations of the macerated epidermis from the action of the water. Fragments of weeds or other substances are occasionally found clutched in the hands. If the substance or object is peculiar to the water, and especially to the water that is found in the lungs and stomach, this is a sign of great importance both as to the fact of drowning and possibly also as to the locality where drowning took place. Sand, gravel, mud or fragments of plants may be found under the nails. Inasmuch as they may be deposited there after death and may get there during the pulling of the body out of the water, their presence is not of much importance, even if the character of the minute shells, diatoms, etc., contained in them enables us to demonstrate their place of origin.

If, in the body of a very young infant that has been found in the water or in any other liquid, the umbilical cord is mummified, we know that three or four days must have elapsed between the birth and the time the body went

into the water. Hence the probability is that the child was not drowned, for it is difficult to believe that a person intending to murder a child would keep it three or four days alive.

In very many cases the fluid in which a person is drowned penetrates the middle ear through the Eustachian tube. The value of the presence of liquid in the middle ear as a sign of drowning depends, of course, largely upon the possibility of its getting there after death. Certain experiments seem to show that in about one case in four, this post-mortem penetration may take place. The question can hardly be considered settled up to the present time.

The best technique for the necessary examination is as follows: Thoroughly cleanse and dry the meatus auditorius externus. Assure yourself by examination with an ear speculum in a good light that the tympanic membrane is intact. Puncture the membrane with a small pipette or hypodermic syringe and remove by aspiration any fluid that may be present in the middle ear. In certain diseased conditions and at certain stages of putrefaction there may be liquid in the middle ear. In order, therefore, to make the most of this sign, it is desirable to identify the liquid withdrawn with that in which drowning took place.

Occasionally the soft parts are more or less extensively eroded by the action of the water, or eaten away by fish or water-animals. Erosion is more apt to occur in parts that were the seats of contusions or lacerations before death; in contradistinction to the marks produced by animals the edges of erosions are softened and poorly defined.

The vernix caseosa is not removed from the body of a child by the action of quiet water in six weeks. Belohradsky, to whom this observation is due, suggests that if the temperature of the water is high and the current strong, it would very likely come off sooner.

Internal Examination. — We now pass from the external appearances to those presented by the internal organs:

The brain and its membranes are more commonly anemic than congested. Hypostasis may be mistaken for congestion, and the large amount of blood that (on account of its fluidity) flows from the severed sinuses may similarly deceive us. Congestion is said to be commonest in those who go into the water intoxicated.

I have met with no observations as to the condition of the spinal cord or its membranes after drowning.

On reflecting the skin and muscles from the chest and neck, in the manner usual at an autopsy, Paltauf has several times observed bilateral lacerations of portions of the sterno-cleido mastoidei or of the pectorales majores, with extravasation of blood between the separated ends of the fibres. He considers these due to violent efforts during drowning, or to the rough application of Sylvester's method of artificial respiration, and not at all due to violence by another.

The mucous membrane of the pharynx is sometimes injected or ecchymosed.

The position of the epiglottis is of no importance. Its mucous membrane

is occasionally injected, rarely ecchymosed. If the body does not lie long exposed to the air, we will often find the aryepiglottic folds swollen by imbibition of water. At first sight it reminds one of edema from inflammatory disease. The larynx itself may contain froth or foreign substances (mud, bits of water-plants, vomitus, etc.), and its mucous membrane may be congested or even ecchymosed.

Before removing the sternum we may be impressed with the protrusion of the intercostal muscles between the ribs, as in cases of pneumo-thorax. This is due to the increased volume of the lungs, which will be considered later.

Pleuritic adhesions exercise an important effect upon the condition of the lung tissue underlying them.

The presence in the pleural cavities of watery liquid, stained more or less with blood-coloring matter, seems to me of much importance in some cases. To be of any diagnostic value, pleurisy must be excluded and putrefaction must be not very far advanced. The amount of this watery fluid is inversely proportional to the amount of moisture in the lungs. I have seen over a quart in each pleural cavity of a body which lay under the ice for a week. The lungs in this case were decidedly dry. Putrefaction had not advanced enough to float the body, to cause the least odor when the body was opened, or any discoloration of the head or face. Authorities differ as to the significance of this fluid, some believing that just as much will transude in cases of death from heart disease with pulmonary edema, or in cases of considerable pulmonary congestion, as after drowning. One would naturally suppose that chemical analysis of the liquid would easily distinguish between transuded drowning fluid and the liquids that might be found in the pleural cavity in the other conditions mentioned.

If in opening the chest any blood-vessels are wounded, the blood (which in drowned bodies is very liquid) is liable to flow into the pleural cavities in considerable quantity. As much as possible this must be prevented.

The pericardium often contains a small amount of liquid. Subpericardial ecchymoses are of great rarity in the drowned; at all events, unless the drowning fluid be of such a density that the person is rather suffocated than drowned. Pericardial adhesions, by interfering with the action of the heart, may favor rapid death in cases of drowning.

Examination of the coronary arteries and cardiac muscle may account for absence of signs of drowning in bodies taken from the water. Degeneration of the heart muscle (usually dependent upon disease of the coronary arteries) will, of course, render the person more liable to death from syncope or shock if he falls suddenly into the water. From the same standpoint, disease of the valves of the heart is important.

The heart should be opened *in situ* for the purpose of determining the condition of the blood in its cavities (whether clotted or fluid) as well as the relative amounts of blood in the two sides of the heart, and whether the color of the blood differs in the two sides. Usually we find the blood decidedly fluid, free from clots, the right side containing more blood than the left, and, according to Barlerin, of a darker color.

For more than a century almost all authors have agreed that the blood of the drowned is strikingly fluid. Of course, we should not expect to find a strikingly fluid blood in those who merely die in the water but are not actually drowned; nor should we be surprised that advanced conditions of putrefaction bring about such chemical and physical changes that the blood no longer gives one an impression of unusual fluidity.

It has been ascertained that if a person takes sulphuric acid, aqua regia, or other caustic poison, and then completes the suicide by drowning, the blood will be clotted. Other chemical changes due to disease, for example, fever, may put the blood into such a condition that it will clot after drowning. We cannot, therefore, say from the presence of clots that the person was not drowned. On the other hand, we find a fluid condition of the blood after many other kinds of death, for example, hanging, strangulation, and all other modes of asphyxia; poisoning by illuminating gas and by some of the narcotics (especially opium); death by lightning or electricity in other forms; and, according to Paltauf, after any form of violent death. The blood of the drowned differs, however, from these other fluid bloods by its being actually diluted by water absorbed through the lungs during the process of drowning. The amount of water thus absorbed varies very much, according to the duration of the drowning (the amount of liquid that penetrates the lungs), the nature of the drowning fluid, and the condition of the lungs themselves.

This diluted condition of the blood is particularly noticeable in the liver. Some authorities, indeed, claim to be able to determine from the condition of this organ alone that the person from whom it came was drowned. They say that if the liver of such a person be removed and laid upon an inclined plane, the amount of watery blood that oozes from it is so great as to permit the diagnosis to be made, and they compare such a liver to a sponge saturated with water. It is on account of this condition of the blood that wounds made post-mortem on the drowned will bleed so much and for so long a time.

In color the blood is dark cherry-red; in mass it is blackish or quite black. Some writers say it is darker in the right side of the heart and veins than in the left side and aorta.

After death from any sort of asphyxia, the right heart is usually comparatively full of blood. Of course, the extent to which the concomitant causes of death enter into the case will exert a modifying influence upon this sign. Then, again, inasmuch as the heart continues to beat after respiratory movements have ceased, it is possible that the last traces of blood received into the heart may sometimes be expelled. Emptiness of the right heart is, therefore, no proof that drowning was not the cause of death. If putrefaction is far advanced the heart will be found empty.

Hyperemia of the pulmonary artery and of the venæ cavæ are of the same significance and subject to the same conditions as the overloading of the right heart.

The experiments of Paltauf convinced him that the blood in the aorta and left heart was more dilute than that in other parts of the body, and, indeed,

that dilution might occur here and not elsewhere. Barlerin, on the other hand, says that the blood in the aorta is thicker and redder than in the veins.

Before removing the lungs from the chest it is strongly advised by some authors that a ligature be tied below the larynx around the trachea to prevent the escape of any liquid contents of the air-passages. Immediately on opening the chest one is commonly struck by the great apparent size of the lungs. They do not collapse. The flat hand cannot, as usual, be laid in the space between the ribs and the surface of the lungs. They are even so distended that the imprints of the ribs are visible on their surface and sometimes they appear to push themselves out as distended intestines do on making a small abdominal incision. The anterior borders of the lungs meet or nearly meet. The heart is nearly or quite covered. The edges of the lobes are rounded. This condition is spoken of as ballooning of the lungs or hypervoluminosity, and is a very important sign of drowning. It is present in more than 90 per cent. of the cases, provided putrefaction is not far advanced. The cause of this ballooning is that, owing to the penetration of the drowning liquid into the bronchioles and alveoli and thence into the interstitial tissue, the lungs cannot collapse. In some cases, too, there may be enough secretion of mucus in the minute bronchi to obstruct them here and there, and thus assist in preventing the normal collapse. That this increase in size is not due to hyperdistention of the alveoli with air is demonstrated by the facts that the specific gravity of these lungs is greater than normal and that their absolute weight is increased.

There are certain other conditions than drowning which may produce a similar appearance of the lungs. These conditions are: large effusion in the pleural cavities forcing the lungs forward, emphysema, broncho-pneumonia and capillary bronchitis; extreme degrees of acute edema of the lungs; and sometimes poisoning by charcoal or illuminating gas. None of these is likely to offer much difficulty in differentiation.

Distention of the lungs by gases of putrefaction can rarely, if ever, simulate this condition. It is much more common for the distention to disappear as putrefaction advances. It has been shown that the lungs of the drowned putrefy very rapidly as compared with other lungs, being reduced to a pulp at a time when the heart is still in such a condition that the integrity of the valves and the gross structure of the myocardium can be readily recognized. In very cold weather, and especially if the body is under ice, the fluid that distends the lungs may transude into the pleural cavities before putrefaction takes place, and the lungs will then be found collapsed rather than distended. Pleural adhesions, particularly if dense and extensive, will prevent this distention; hence sometimes one lung will be ballooned and the other collapsed. These hypervoluminous lungs are of a flabby, doughy consistence and pit on pressure. They usually crepitate more or less on pressure or on section.

The color of the surface of the lungs is not uniform. We may say, in general, that on the anterior parts, on the rounded edges and towards the apices, the prevailing color is pale yellowish-red; elsewhere the tint is much darker. The lobulation is usually distinctly marked; and while each lobular area is

pretty much of one tint, adjacent lobules may vary considerably, whence arises the marbled appearance of the lungs. The special tint of a lobule depends on the quantity of blood that it contains, and this again depends upon the amount of drowning fluid that has penetrated the lobule in question; the more drowning fluid the less blood and the lighter the color. In the paler lobules, and especially at the anterior edges of the lungs, one can see, through the pleura, distended alveoli, while in other parts and in the grayish-blue or dark reddish-violet lobules the alveoli are smaller and less distinct.

On the surface of the lungs we may also find extravasations of blood. These are of two sorts: (1) Regular subpleural ecchymoses, the so-called Tardieu's spots. These are rare, commoner in children than in adults and in those drowned in thick fluids than in those drowned in water. (2) Larger, paler spots, consisting of a mixture of blood and drowning fluid poured out under the pleura in consequence of the rupture of alveolar walls. These are liable to be confused with patches where the alveoli are merely full of the drowning liquid, and with patches where the pressure of the fingers has forced out a little air that was present in the alveoli, leaving behind the liquid that was there.

Besides the extravasations just mentioned, subpleural patches of emphysema are sometimes observed. This occurs most frequently in children, and is generally found at the edges and on the median surfaces of the lungs.

The contents of the air-tubes consist of froth, liquid, foreign substances that were suspended in the drowning liquid and matter from the stomach.

The froth is produced as follows: During the process of drowning a certain amount of liquid enters the air-passages. In consequence of the irritation produced by this liquid a little mucus is secreted. The powerful respiratory movements churn up this liquid and mucus with the air in the tubes and produce a fine-bubbled, whitish froth. The amount of this froth depends upon the force, frequency and number of the respiratory movements. It may fill completely the whole bronchial tree, the trachea and larynx, and even appear at the mouth and nose. On the other hand, very little may be formed, and it may be limited to the very small bronchial tubes.

The sooner the body is observed after death the better marked will this sign be. As time goes on, the fine bubbles will unite to larger ones, these in turn will collapse, and so a part of the froth will be converted to liquid. In consequence of the development of the gases of putrefaction and their pressure upon the lungs, the froth will be gradually forced out of the mouth. That which comes at first will be whitish, for it was formed in the larger tubes where there is no effusion of blood; then comes a rosy froth, rosy from the admixture of blood-coloring matter which comes from minute hemorrhagic foci in the very small bronchi; and finally the true froth is all gone, and there exudes from the mouth only a reddish or brownish, dirty, ill-smelling liquid containing perhaps a few bubbles of gas and in no way characteristic.

The real froth lasts in winter from three to five days, in summer not over fifty-five or sixty hours. If a body is removed from the water the froth disap-

pears much more rapidly. In summer as short a time as two hours may suffice for it to disappear.

The great question in regard to this froth is whether it can in any way be distinguished from that which is found in the air-tubes after death from other forms of asphyxia; from poisoning by illuminating gas, by charcoal gas or by narcotics; from epilepsy; or from any disease associated with congestion or edema of the lungs. No unanimity of opinion exists on this question, which as far as I can ascertain has not yet been attacked in the way that one would suppose the most natural, namely, by comparative chemical analysis of the frothy liquids found under these various conditions. One would suppose that the froth of the drowned would contain very much more water than the froth produced under any other conditions.

As to liquids in the bronchi, observation and experiment have proven that the drowning liquid enters the air-passages and reaches even to the alveoli, many of which are filled with it; and further, that it passes between the epithelial cells of the alveoli and of the bronchi and gets into the lymph-spaces and lymph-vessels of the interstitial tissue. The quantity of liquid that thus enters the lungs varies, of course, with the number and force of the respiratory movements during the process of drowning. Chemical analysis has shown that the liquid in the air-passages of the drowned consists almost exclusively of the drowning fluid. With this is mixed a very little mucus, a still less amount of blood and some epithelium, with perhaps mere traces of edema fluid.

The liquid is not always found in the air-tubes of the drowned, for it may pass into the pleural cavity by transudation, it may be forced out of the nose and mouth by the pressure of the gases of putrefaction, and it may flow out after the body is removed from the water if the head is allowed to assume a dependent position.

Moreover, if a body is immersed after death, the liquid will get into the air-tubes. It is a question how far into the tubes the liquid can penetrate after death; certainly sometimes as far as the eighth division of the bronchi, and some writers say even into the alveoli. The latter is doubtful. The more deeply the body is immersed the more deeply it seems the fluid will penetrate.

Foreign substances, such as mud, sand, fragments of water-plants, etc., with the water, may enter into the air-tubes. They may enter after death. The deeper they are found, the less is the probability that their entrance took place post-mortem. How deeply they may go post-mortem is not yet definitely determined.

In the progress of the asphyxia vomiting often takes place. The vomited matter may be drawn into the air-tubes by a violent inspiratory effort. It is said that even after death, the contents of the stomach may get into the air-tubes.

As in any case of suffocation so in drowning, we usually find more or less injection of the mucous membrane of the bronchi and trachea. It varies from a few isolated dendritic patches to a tolerably uniform coloration of the whole

mucous membrane. The shade of color is cinnabar red to vermilion, and differs distinctly from the dirty brownish-red of putrefaction. Frequently the injection is limited to the epiglottis and the bifurcation of the trachea, extending a little into the primary bronchi. Slight grades of injection are most distinctly seen between the cartilaginous rings and on the posterior wall of the trachea.

On section of a drowned lung, one is almost always first impressed by the large quantity of frothy liquid that seemingly exudes, spontaneously or on slight pressure, from every point of the cut surface. Careful examination, however, causes one to modify his first impression. If the body is quite fresh the tissue near the root of the lung and the upper lobe are more filled with fluid than other parts, and within any limited area differences in color, moisture and blood contents can be made out between neighboring lobules or groups of lobules, those which contain more moisture and less blood being paler than the others. On the whole, such a parenchyma is pale rather than congested, though here and there patches appear which are comparatively collapsed, dark-colored and loaded with blood.

Many of the alveoli contain liquid; some of them have ruptured and allowed the liquid to be extravasated into the surrounding tissue. The epithelium of many of the alveoli and minute bronchi is swollen by imbibition and often detached from the basement membrane. Some of these cells may have undergone granulo-fatty degeneration.

All parts of the parenchyma are infiltrated with the drowning fluid; but it is a noteworthy fact that if the whole or any part of a lung is adherent, we find the adherent portions comparatively dry. In edema of the lungs we find, on the contrary, if we find any difference between the adherent and non-adherent parts, that the adherent are most saturated with fluid.

There is no doubt that the drowning liquid enters the stomach by swallowing in greater or smaller quantity in most cases. The experiments of Liman, Hofmann, Lesser and others prove that liquid may also enter the stomach after death, carrying with it any suspended matters. The exact conditions for this have not yet been worked out. Liquid is not always found in the stomach of a drowned body, for it may transude, it may be forced out by the development of gases of putrefaction, and it may flow out in consequence of the position or manipulation of the body after withdrawal from the water. Of course, water may have been swallowed shortly before submersion. This objection can be met by an identification of the liquid found in the stomach with that in which drowning is supposed to have taken place, at least when the supposed drowning liquid is of such a character that a sane person would not drink it. This identification can often be made by chemical and microscopical examination; sometimes the odor of the liquid suffices.

The presence of food in the stomach interferes with the recognition of the presence of the drowning liquid (unless this should happen to be some peculiar fluid) although sometimes it forms a separate clear layer on the surface of the pultaceous food mass.

In the case of a new-born infant we must remember that, while yet in utero,

movements of deglutition take place, and that similar movements may occur if the infant be born into a pool of amniotic fluid, blood and mucus as so frequently happens. Hence the presence of these substances in an infant's stomach is of no diagnostic value.

Some of the froth found in the air-passages may come up into the mouth and pharynx, and be swallowed. In such a case we will be likely to find air bubbles in the fluid contained in the stomach. Unless the body is fresh, the stomach free from food and containing a considerable quantity of fluid which can be demonstrated as identical with that in which drowning is supposed to have taken place, we can hardly lay very great stress upon this sign. Under these circumstances the fluid is cloudy from mucus and epithelium.

The mucous membrane of the stomach is usually, in fresh bodies, pale, as if water soaked. If much food is present, the membrane is likely to be rosy-red; sometimes, as in other kinds of asphyxia, it is injected or ecchymosed, as is also that of the intestine. In consequence of putrefaction it acquires a deep violet or brown color which is liable to be mistaken for the result of poison.

Drowning fluid may be found in the small intestine, especially in children. Liman says that this is purely mechanical. This subject has been thoroughly studied by Fagerlund whose conclusions are that: (1) The drowning fluid does not pass from stomach into intestine post-mortem unless very considerable pressure is brought to bear. (2) In a drowned person peristaltic action may carry liquid from the stomach into and along the intestine. This is more easy when the stomach is empty, and more common in prolonged drowning. This sign is then more important apparently than the presence of water in the stomach.

The spleen, kidneys and mesenteric veins are all gorged with blood, as in any case of asphyxia. This engorgement disappears as putrefaction progresses.

The position of the diaphragm and the condition of the urinary bladder are of no importance.

If we now have a particular case under examination, what conclusion can be drawn?

From our examination of the exterior we can say, "This body has been lying in the water," basing our opinion on the presence of more or less of the following signs:

(1) Peculiar rose-colored or bright-red suggillations.

(2) The order in which the parts have been affected by putrefaction.

(3) Rosy patches on the skin of the inner surfaces of the thighs and front of the thorax.

(4) Cutis anserina.

(5) Retraction of penis, scrotum and nipple.

(6) The extent of subcutaneous emphysema.

(7) The condition of the epidermis, particularly of the hands and feet, knees and elbows.

(8) The condition of the nails and hair.

(9) The appearance of the various parts of the eyes: (*a*) The so-called fish-like expression, (*b*) the phlyctenular eminences and cloudy appearance of the cornea, (*c*) the sclerotic edema, (*d*) the change of color of the iris.

(10) Abrasions about the bridge of the nose.

(11) Sand, mud, fragments of water-plants, etc., in the nostrils and mouth.

(12) Mud, etc., under the nails.

(13) Fragments of plants, etc., grasped in the hands.

(14) Erosions of various parts of the body.

(15) A fine-bubbled froth at the mouth and nose.

To these will perhaps be added after we have made our internal examination:

(16) Edema of ary-epiglottic folds.

(17) Fluid in the larger air-tubes (and in this fluid very likely foreign particles may be found suspended).

(18) Fluid in the stomach.

Now among all these signs there are none that are incompatible with the cause of death being drowning, and a few of them suggest this quite strongly, or at least suggest that the person was alive when he went into the water. These are —

(1) Cutis anserina.

(2) Retraction of penis, scrotum and nipple.

(3) Fragments of water-weeds, etc., grasped in the hands.

(4) Froth at the mouth and nose.

In order to be able to say positively, "This person was drowned," a careful consideration of all the internal organs, and in some cases of extraneous circumstances, must also be made.

(1) It appears to me that the absence of any traces of external violence is a very important matter; and if such traces exist, the determination of whether they were inflicted before or after death, and whether they are sufficient to account for the death.

(2) We must consider the general indications of asphyxia; by which I refer to the congestion of solid viscera, the overloading of the whole venous system, the injections and ecchymoses of mucous membranes, the fluid condition of the blood, and the presence of subpleural and subpericardial ecchymoses. In proportion as more of these are present, so much the more positive will our diagnosis be, for we must remember that drowning pure and simple is but one form of asphyxia.

(3) Evidence of chronic or acute disease must not be neglected, for by the presence of such disease the resisting power of our subject will be diminished, and he will require (if I may use an Irishism) less drowning to kill him, and consequently the signs will be less pronounced. Such disease, moreover, may furnish a motive for suicide.

(4) Finally, we have certain signs more or less special to drowning which, taken in connection with the signs already referred to, make our diagnosis in many cases positive. Some, perhaps all, of these signs, yet require investiga-

tion to thoroughly determine the limits to which their value is confined; and I shall take the liberty, even in this assemblage of experts, of calling some attention to this part of the subject.

(1) Bilateral lacerations of the sterno-cleido mastoidei and pectorales majores. These are mentioned by Paltauf only; more observations are needed.

(2) Liquid in the pleural cavities; lesions to which this might be due being absent. Comparative analysis ought to be made of this fluid, of pleural effusions, and of the liquid that collects in the pleural cavities in consequence of putrefaction.

(3) A fine-bubbled, watery, whitish or rosy froth, non-adherent to the walls of the air-passages, in which it is found. Inasmuch as the most eminent authorities are not agreed that this can, by any physical characteristics, be distinguished from the similar froth found in other forms of suffocation and in certain diseases, let us make comparative analyses of all these froths and determine, if we can, any chemical differences that exist between them.

(4) The presence of the drowning fluid in the very small bronchi and the alveoli, with or without suspended foreign substances. The question still at issue here is, How deeply can fluids penetrate into the bronchi after death?

(5) An infiltration of the pulmonary parenchyma with fluid. The presence of pleuritic adhesions will enable us to distinguish this condition from edema in many cases.

(6) Subpleural extravasations of the drowning fluid mixed with a little blood.

(7) Increase in the volume of the lungs, associated with increase of absolute weight, increase of specific gravity and a peculiar doughy consistence.

(8) Demonstration of hemorrhagic foci where the bronchioles enter the alveoli.

(9) Presence of water in the stomach. The very fact that this may enter after death is still contested, and we only know in regard to the conditions necessary for such entrance that it is favored by pressure, for example, by the body being sunk deep in the water.

(10) Water in the intestine. Unless great pressure is brought to bear on the body, water will not pass from the stomach to the intestine. How much pressure is required and the influence exerted by putrefaction upon this pressure, we have yet to learn.

(11) A special and extreme hydremia of the liver. I cannot believe that it accords with the true scientific spirit to ridicule, as some authors do, the statements of Lacassagne on this point. Careful comparison of the condition in this respect, of livers of persons dead of all sorts of violent deaths would be much more to the point.

(12) An actual dilution of the blood with the drowning liquid.

In conclusion, gentlemen, I wish to say that I have refrained from enumerating my sources of information, with the object of shortening the time required for the reading of my paper. I shall be pleased to give any who wish to consult them all the references at my disposal.

DISCUSSION.

DR. SMITH, of Portland: It seems to me the subject has been more than exhaustively covered, and as a work of reference it cannot fail to be of essential service to the members of this Society and any one else who may have access to it for that purpose. I was particularly struck with an allusion which the reader made to the importance of placing a true estimate upon wounds upon the body. To me this has often proved a source of considerable annoyance and some apprehension. As most of you know, in the State of Maine we have no law controlling autopsies upon the dead bodies found in suspicious circumstances. Most of the autopsies are made at the discretion of the coroner — probably, all things considered, one of the worst things to further the ends of justice that could be advised. I have on several occasions been a good deal puzzled by marks on the body, some of which I have not found mentioned in works treating upon this subject. Of course, in a general way we should endeavor to account for wounds and for bruises or other lesions of the surface in the ordinary way, judging somewhat by the amount of discoloration, the particular portion of the body affected by these marks, bearing in mind the limitations made by immersion in the water, by the peculiar circumstances under which they are found; but it often becomes an exceedingly nice point, especially in cases of bodies found drowned when it may be suspected that the individual was intoxicated when he went into the water. Sometimes it is not only difficult, but absolutely impossible, to say whether an injury was received when the body fell from a bridge or wharf into the water, or whether it was received after death from drowning yet while the body was still warm. A year or two ago I met with a form of mark upon the body which I had not seen before, which was easily explained after a little investigation. I was called by a coroner to make an autopsy upon a body found floating in the dock, and from every evidence it was probable that the body had not been immersed more than ten or twelve hours. Information came to me at the time I was called that violence was suspected, because there was evidence on the face and side of the head of marks. I found the body in pretty fresh condition, with an area of discoloration upon the left side of the head just below the zygoma, and the temple and cheek and side of the neck finely spattered as though the skin had been perforated by powder-grains and the body had been superficially washed. I looked it over, examined it carefully, got out two or three of the grains, rubbed them in my fingers and they gave a pretty black mark. I took a sponge and carefully scrubbed the skin, and found the site of every one of these little black marks was a cleanly cut and chiselled wound, and microscopical examination of the material removed from the incisions showed it to be earthy matter, clearly the mud of the dock in which the body had been floating, and the little marks in the skin had been made by the edge of the little barnacles where the body had been washed back and forth and the head struck against the piling, and the marks were as beautifully done as though done with an instrument. The physician first called to see the case allowed his lack of judgment to get the better of him,

and gave the coroner points on the powder-marks — and to the inexperienced eye they did seem to be such. Perhaps that is extraneous to the discussion. I introduce this as bearing in an interesting way upon the variety of marks that may be found. That impressed upon me the necessity for avoiding hasty judgments in cases of this kind, particularly where our actions and the circumstances of the case are likely to be the subject of public discussion in the papers.

I wish to express the great pleasure I have experienced in listening to the paper.

A CASE OF CRIMINAL ABORTION WITH PECULIAR FEATURES.[1]

BY W. S. BIRGE, M.D., OF PROVINCETOWN.

Medical Examiner.

THE paper that I am going to present to you to-day is not a literary article, but simply the history of what has been to me a very interesting case — a case of criminal abortion presenting some peculiar features.

By abortion is commonly understood in medicine the expulsion of the contents of the uterus before the sixth month of pregnancy; between the sixth and ninth months the woman is said to have had premature labor. The law makes no distinction of this kind, but the term abortion is applied to the expulsion of the fetus at any period of pregnancy. Criminal abortion, according to most authorities, is rarely attempted before the third month; it is perhaps most common between the fourth and fifth months, for it is not until such a time that the woman is positive in regard to her pregnancy; after the sixth or seventh month it is again rare for a criminal operation to be performed. In the case I am about to relate, it is supposed that a criminal operation was done at or about the eighth month of pregnancy.

On the morning of April 26, 1894, a laborer passing by what is known as the Mill Pond in the village of W——, saw the body of an infant child floating on the surface of the water. He at once notified his employer, who was deputy sheriff and also undertaker; the remains were removed to his office, and I was notified.

On viewing the body, the following facts were presented: It was that of a male child of fairly good size, but with the appearance of having been born at or about the eighth month; the skin was well filled out; the length of the body was fifteen inches; the nails were firm, but not reaching to finger-tips; the membranæ pupillares had disappeared; the hair was well developed; the skin was of a greenish color in places showing that putrefaction had commenced. Attached to the child was a piece of the umbilical cord, some eleven inches in length, which had the appearance of having been forcibly torn apart.

An autopsy being deemed necessary, the proper authority was obtained and a full examination was made.

On opening the thorax, the lungs were first examined; crepitation was obtained upon pressure and they were found to be fully inflated, markedly so, for every portion showed great buoyancy when submitted to the hydrostatic test. They were not inflated with gas caused by putrefaction, for they were in a very good state of preservation. My experience has been that the lungs

[1] Read at the Annual Meeting, June 11, 1895.

are slower than other organs of the body in undergoing putrefactive changes. The heart, lungs, and in fact all the organs, were almost entirely bloodless; the foramen ovale was partially closed. Meconium was found in small amount in the large intestine. One testicle had descended into the scrotum, the other was in the inguinal canal. The abdominal cavity was somewhat distended with gas.

From the foregoing we arrive at these conclusions:

(1) The child was born alive and must have lived some little time, for the lungs to have been so thoroughly inflated.

(2) From the bloodless appearance of the body hemorrhage must have ensued from the cord sufficient to cause death, although contrary to the general rule, and what we might expect when the cord was forcibly ruptured or torn apart at such a distance from the child's abdomen.

In a house, the yard of which bordered on the pond where the child's body was found, lived a young woman of eighteen with her parents. She moved in a society rather superior to that occupied by them, although they were eminently respectable people. A short time previous a rumor was in circulation that the girl was pregnant. She was keeping the company of a young man in an adjoining town. As they were frequently seen together, this tended to strengthen the impression. A fortnight before finding the body she had been confined to the house for nearly a week with a severe cold, so her mother informed a neighbor; however, she was soon out again apparently as well as ever, although some ventured the remark that her shape had changed. As I say, this was only a vague rumor, and had only excited slight comment; and if the finding of the body had not turned our attention directly to it, it would have been forgotten.

Before concluding my report, I visited the house in company with the deputy sheriff. The family consisted of the father, mother, three small children, the young lady in question and an old grandmother. Upon being interviewed, the young girl, who was very much frightened, burst into tears and told the following story:

She had been keeping company with a young man for some time, and had had illicit intercourse with him quite frequently, as she had also with two or three other male friends; finally, through her indiscretion, she became pregnant. She tried to prevail upon this particular young man to marry her, but he kept putting her off from time to time until, finally, he refused to marry her, but said he would take her where she could have an abortion performed and so get out of the trouble that way.

Fifteen days previous to the autopsy she went with him to the office of a physician in a neighboring town who, she said, had agreed to perform the operation for twenty-five dollars.

Her companion remained in the waiting-room while she retired with the doctor to his private office, where she remained nearly an hour; during which time he made an examination of her person, using various things which she

did not understand the use of and could not describe, as she did not see them; finally, he passed something into the vagina which he told her was a boroglyceride suppository; and to retain it in position, he put up a tampon of cotton which she was to remove by means of the attached string, at the end of the twenty-four hours. He also gave her three vials: one contained tablets to be taken one after each meal; another, a liquid, of which she was to take ten drops in water between meals and at bedtime; the third, tablets to be dissolved in water and used for an injection. The following evening, not experiencing any effect from the treatment received or the medicine taken, in company with her young man she again visited the doctor's office; this time the young man had some words with the doctor in regard to paying the bill; the latter became very angry, swore at them and ordered them to leave his office.

The next day she returned to her home, and the day after was taken with severe pains in the back and bowels, with flowing. She always suffered pain at her monthly periods, and told her mother and grandmother that she was unwell. She occupied a lounge in the sitting-room the greater part of the day, and the old grandmother put hot plates to her bowels, gave her "pain-killer" and hot drinks, hoping to relieve her. Just before tea-time she arose, went to her room and lay down on the bed. In about half an hour, while the family were at tea, she gave birth to a child, the placenta soon following. Getting up, she rolled up the child and afterbirth in an old petticoat and secreted them under the bed, where they remained until the next evening.

The following day, she arose at noon and dressed herself; that evening, when she could do so unobserved, she took the child, together with the afterbirth and some soiled clothing, out into the orchard and buried the same in a hole in the ground. Two days later, hearing her father speak of plowing up the orchard, and fearing that he would discover the child, she went that night and dug up the remains, and putting them into a six-quart pail with some stones on top, carried them to the pond and threw them in.

The girl said that no one in the house was aware of her condition, and that none of her family, not even the old grandmother, knew or suspected that she had given birth to a child.

Cases of concealed birth are not a great rarity, but they usually occur under different circumstances. It does seem somewhat improbable that a young girl could become pregnant, go to the eighth month, and then be taken sick and give birth to a child, with mother and grandmother (the latter a midwife for years) in an adjoining room and they not know of it; and then, allowing that such a thing could occur, to still further carry out the deception by secreting the product of her conception in her room for twenty-four hours or more; then to bury the same; and, finally, two nights later, to dig it up and consign it to a watery grave — all this seems almost incredible.

The mother seemed positively amazed when confronted with the facts, but stoutly denied any previous knowledge of the case; the old grandmother likewise professed her ignorance; and as the girl's story confirmed theirs, there

seemed to be no other alternative than to accept it as true until something further developed to give a different tone to the picture.

At the hearing, held a few days later, the girl told the same straightforward story without varying a particle. Her young man, although previously denying all knowledge of the affair, on being put upon the stand confessed the whole. His story in regard to visiting the doctor's office agreed with hers perfectly. The amount of money he promised to pay the doctor was twenty-five dollars. At the first visit he paid two dollars; on the following evening when they called, he offered the doctor half the amount promised, and agreed to pay him the remainder when a satisfactory result was obtained. This incensed the doctor very much, he demanding the whole. One word led to another, until finally he ordered them both from the office. The doctor, on being sworn, said that the couple came to his office as stated; that nothing was said about an abortion; that he made a vaginal examination, found a very filthy condition, profuse leucorrheal discharge, pruritus of vulva and anus, aggravated by a multitude of seat-worms. He said he did not know at that time that she was pregnant. He washed out the vagina, put in a boroglyceride suppository followed by a tampon of absorbent cotton to hold it in place. He gave her a vial of permanganate of potash tablets to use in an injection once a day, a vial of Wyeth's tablets of iron, arsenic and strychnia, to take one after meals; and a vial of homeopathic tincture of nux vomica to take ten drops in water, between meals. He said he asked and received two dollars for treatment and medicine.

The second time they came, he was asked to perform an abortion, some talk was had in reference to it, the young man offering him twenty-five dollars in cash, which he refused. They had some words over it, both giving vent to their feelings; he finally ordered them from his office. He had nothing to do with performing an abortion, and did not know except from their own story that she was in the family way.

At the conclusion of the hearing, the court, deeming the evidence sufficient, bound the doctor over to the grand jury in the sum of five thousand dollars, on the charge of criminal abortion. The young man, as accessory before the act, was bound over in the same amount. The young lady, as she had turned State's evidence, was allowed to go on her own recognizance, no charge at that time being preferred against her.

I cite this case as one of more than usual interest. It is very seldom that even the professional abortionist will perform an operation upon a woman at such an advanced period of pregnancy as in this case. The young woman, it would seem, could have no object in evading the truth in regard to the circumstances attending her confinement, unless it was to shield the mother or grandmother, who might have aided her at that time or afterwards have disposed of the child. She said she supposed the child was dead when born as it never made any out-cry or noise of any kind.

The physician was indicted by the grand jury for the crime of inducing an abortion, the young man as accessory before the act; the young woman went

on her own recognizance. If she had also been indicted, the question would have undoubtedly arisen later, Was she guilty of infanticide or simply of concealment of a birth? The common law holds that a woman is not legally responsible for an omission causing the death of her child when she is alone and has no one to assist her in or during her confinement; but in this case, in submitting to a criminal operation, she signified her consent to the destruction of her unborn child, and at the time of birth she could easily have had the assistance needed by calling the mother or grandmother from the adjoining room or summoning one of the two physicians who were within five minutes' walk of the house.

In the discussion which follows the reading of this article I trust it will be strongly urged that a more determined action be taken by all regularly registered physicians and especially by the medical examiners of the Commonwealth, to bring to justice these so-called physicians who are engaged in this nefarious business.

DISCUSSION.

DR. QUIMBY: I was very much interested in the paper. I once had an experience in which the body of an infant was found concealed in an ash-heap in the rear of a house. On looking into the matter it was learned that the servant girl had been complaining of being unwell with the "summer complaint." This girl arose in the night, and was gone out in the yard an hour or so. The mistress of the house heard her as she came in and asked what the trouble was. She replied that she had diarrhea and had been out to the closet. The case came to trial before the grand jury. The cord was six or seven inches long. The child had evidently bled to death. The mother was allowed to escape on the ruling of the court that there was no evidence to show whether the child might have bled to death before fully born or not. She said she became unconscious, and while she lay there the cord was broken. There was no penalty beyond the matter of concealing the birth of the child.

DR. HOUGH: I should like to ask what the condition of the lungs was in the case that Dr. Quimby reported. If the lungs were fully inflated it would seem as if the child was entirely born before it died.

DR. QUIMBY: The lungs were inflated with air. They asked if the child could not have breathed when partially born, and I could not say; and on that technicality the girl escaped. I thought she ruptured the cord and allowed the child to bleed to death, but could not say so.

DR. ADAMS: As to the possibility of concealment of pregnancy, I recall that almost the first puerperal case I was called to was that of a young woman who, her mother told me and I had every reason to believe it, carried a child to full term and it was born without their having for a moment suspected she was pregnant; and the child weighed about nine or ten pounds. She was a woman of ordinary size. So that it is not such an incredible thing as might at first appear that a woman should live among her relatives and carry a child to full term and not be suspected.

DR. HARTWELL: I should like to emphasize the President's statement with a case I had. A woman from the city came into the country seeking employment. She got employment in a family occupying a high position. Her condition was not suspected. After she had been there two or three weeks she felt unwell one morning, and said to the people that she had been to the water-closet several times during the night with an attack of diarrhea. They did not think it strange until the husband discovered the after-birth in the privy, recognized it as such, and the wife also said it could be nothing else. She accused the girl then and there, and she acknowledged that she had been pregnant and had borne a child, and told where it was. It was found with distinct marks of strangulation. She stated that the child was mature, weighed nine or ten pounds, that she came there with the purpose of getting rid of it, and that she choked it to death. These people employed the girl without suspecting pregnancy, and did not suspect it after the child had been born. The woman was arrested, but escaped from the officer and was never found.

DR. HOITT: I think this matter of criminal abortion should be taken up by the Society at some future meeting and discussed. I think it is a serious question to take into consideration. Within the last two months in my city, we have had two cases of the kind where children have been thrown away in this same way. I may mention a case where a lady came to town for the purpose of having an operation performed, and made application to one physician who refused, went to another who performed the operation, he making the subsequent calls. She and the family becoming somewhat dissatisfied with the treatment, a rival physician was called in who at once exposed the thing to the friends who had not been made acquainted with the facts, she being in a dangerous condition, as he thought. Believing herself at the point of death, she confessed. The judge requested me to go in company with the Clerk of the Courts and take her ante-mortem statement, which I did. She confessed that she went to his office with the express purpose of getting rid of a child, and not for the benefit of her health as he afterwards claimed in court. Finally, she recovered. The State did not work up the case one particle, and the accused was discharged. There was positive proof of guilt. There have been several such cases in the city of Marlborough in the last year, and I think it is a matter that should be looked into. Men are going boldly into this business, not only in Marlborough but in Boston, and I think it is our duty to expose these matters in order to stop this criminal work. In the case referred to, the ante-mortem statement was not introduced into the trial, as the woman lived.

DR. HOUGH: I have been informed by a legal authority that it makes no difference whether the person recovers or dies after the making of an ante-mortem statement, believing that he is going to die. It holds, and a case was stated to me where a person's ante-mortem statement was used in court to contradict the statement made after the person recovered.

DR. HARTWELL: I think the doctor is right in relation to the ante-mortem

statement. I have heard eminent legal authorities say it makes no difference whether the person lives or dies, that a statement made with the fear of impending death was of the nature of a statement under oath and had that same effect before the courts. I think the courts are not wholly to blame in the matter of prosecutions. A case once occurred in which I officiated. A physician was convicted of manslaughter. The court never sentenced him and he went free out of the court-room. I do not remember whether there was an ante-mortem statement which the court would accept as being of the nature of a statement made under oath or not, but it was a most estimable young lady of the city of Marlborough, and she made certain statements which aided very materially in his conviction. But the sentence was never given.

DR. HOITT: For the information of this Society I will say that that case came up and was put over from term to term, and a petition was circulated requesting the judge, on account of the defendant's age and his good behavior in years past, to be lenient in his decision. The physician is now dead.

DR. HARRIS: There is no doubt that criminal abortion, certainly in Boston, is very prevalent. I don't think I exaggerate when I say that not a few are performing three or four criminal abortions every day and oftentimes for the modest fee of ten dollars. The reason that these people are not convicted lies first in the great immunity from danger of this operation. It ordinarily means a short indisposition, and most of them get off with their lives and then they do not tell. Another reason why they fail of conviction is because, while we, as medical examiners, know what steps to pursue, we are not in attendance, and the physicians in attendance do not know or do not take the proper measures to secure the conviction of the individual who performs the operation. The registered physicians of Massachusetts ought to know that in each of these cases they would further the ends of justice by obtaining this ante-mortem statement and also the conditions under which it must be obtained, that is, there must be collateral proof that the woman believes she is going to die, otherwise the testimony is of no avail. As citizens, it seems to me it is our duty to inform the physician in attendance what steps to take in order that these people may be convicted.

In regard to this matter of the ante-mortem statement, the gentleman is right in saying that a statement made in the belief of impending death can be used to contradict a witness if put on the stand. I do not believe it can be used if the witness is alive and testifies herself. If she testifies and contradicts that statement, it can be used. I would say, further, that two cases have come under my observation where women servants (in one case six weeks and in the other two months before delivery) had not been suspected of being pregnant by the people in the house. In one case the woman was found with a child on the floor of the kitchen, where it was concealed through the instrumentality of the milkman; and in the other case, both woman and child were found dead, the woman having had a post-partum hemorrhage. So that the concealment of pregnancy under those circumstances is a tolerably easy matter.

DR. PINKHAM: One registered physician in Boston is well known in our community as a skilful abortionist who performs operations according to the demands of antiseptic treatment, and she also refers her patients for after-treatment to some regular physician. It is not uncommon to have patients come to the office to be treated for some uterine disease, and say that they have had so many abortions produced and some of them quite recently. The fact I wish to emphasize is, that that physician secured registration and is on the same standing as ourselves as regards the practice of medicine in the State of Massachusetts.

DR. HOUGH: I happened a few years ago to come across a case of concealed pregnancy where a girl living with her father and mother came to term. She told her people she had cramps in the stomach and they sent for a physician, who came and found what the trouble was. The girl asked him to shut the door, which he did. He delivered the child, wrapped it up in a shawl, passed it out of the window to the father, and the child is alive to-day. The matter of ante-mortem statement is one I have had some question about in a case of abortion within a week. The attending physician in this case took legal advice about the ante-mortem statement so as to be sure he had it straight. He consulted one of the best lawyers in New Bedford, and followed his instructions, but he did not get an ante-mortem statement that any court would allow to go in. He was not able to show that the girl believed she was going to die. That is the whole point.

DR. BIRGE: I would like to ask if the physician performing the abortion in a case of that kind is responsible for the death of the child, or is it the mother?

DR. PINKHAM: I should think they were both responsible.

DR. HARRIS: It seems to me, in the case reported, the child was born alive. Then the mother was responsible if any one. In certain conditions the law would hold the mother not responsible. If the child is born dead the physician is morally responsible, but can only be prosecuted under the law of criminal abortions, not under the law against infanticide.

THE GILBERT MURDER TRIAL.

A Medico-Legal Review.[1]

BY F. W. DRAPER, M.D., OF BOSTON,
Medical Examiner.

The victim of the homicide which is the subject of this report was a girl of eight years, whose short stature of three feet and nine inches and weight of less than fifty pounds represented better an age two years younger. Her bright, childish ways made her a favorite in her neighborhood and she received with indiscriminate readiness the good-natured familiarity of those who frequented her father's shop near her home. Her precocity, rather than her beauty, attracted attention, but never, so far as is known, transcended propriety.

The defendant, Angus D. Gilbert, was a young man twenty-nine years old, a native of Nova Scotia. His father was a chronic inebriate and his mother had had a brother and a sister who were insane. The death of his mother left him in a moody condition of mind and created in him a restless desire to leave his home and to seek a livelihood elsewhere. He came to Boston eight years ago and has worked continuously at one place, serving as a man of general utility about a large boarding house at Savin Hill. His duties were not irksome and in the evening he supplemented his day-work by caring for the neighboring railroad station. He occupied at night a room furnished for him in an unused stable adjoining the house of his employer; under this stable was a cellar, easily accessible from the outside by several doors and from the floor above by a stairway.

During his eight years' residence at Savin Hill, Gilbert had an excellent name for quiet, praiseworthy behavior; he was obliging in disposition and faithful in the discharge of his duties. Before the present affair, his record was free from any charge of wrong-doing. The one recognized stain in his record was occasional indulgence in intoxicating liquors; this had never gone to the point of incapacitating him for the discharge of his duties, and was known only by the loquacity and the flushed face which it caused. The indulgence was intermittent; and it is established that he had been drinking too freely during the morning of April 10th, the day of the homicide.

In his physical appearance, there was nothing to suggest a wicked nature. He was below the average stature of adult manhood, rather spare and not ill-looking. His face invited confidence, and had no indication of either grossness or malice. He would be accepted as an ordinary young man, free from guile.

In the afternoon of April 10th, the young girl disappeared. She had her

[1] Read at the meeting of the Society, October 2, 1895.

dinner with her brother, played around her father's shop for a time, then vanished. No alarm was felt until the evening, when her failure to return home excited natural apprehension. Next day, her father and some of his neighbors began to search for her. In this search, Gilbert joined, and, in the presence of witnesses, made use of emphatic execrations upon the man who had enticed the child away. But police inquiry soon uncovered facts which directed attention to Gilbert himself; it was learned that he and the girl were seen together at a little distance from her father's shop and a short time after the father had last noticed her. One witness after another was found who saw the two together on the way leading to Gilbert's premises; they were going along in the most amicable manner, sometimes hand-in-hand, and all the time without any sign of restraint or coercion in the girl's movements. Their route did not follow the highway, but leaving the public street, took a course across the railroad tracks and along a pathway at the upper edge of a marshy area, to the foot of a street upon which Gilbert lived; and scarcely a rod of this course was unobserved. They went openly and with friendly freedom and were last seen walking along toward the stable where Gilbert roomed.

These facts, attested by so many witnesses, justified the propriety of holding Gilbert on suspicion, and he was taken into custody on the afternoon of April 13th. Immediately after this was done, the police, although not yet in possession of any real evidence involving Gilbert as the author of a cruel crime, directed their efforts to a thorough search of the premises occupied by him. They examined his room and were rewarded by finding blood-stained trousers hanging with other clothing, without any attempt at concealment. They found, also, three handkerchiefs and a towel with suspicious stains upon them.

They then turned their attention to the cellar under this room. After a little investigation, one of the officers found a spot where the soil was loose, and carefully scraping it away he soon uncovered a child's foot; a little more earth was removed, and the body of the missing girl was revealed lying face down in the shallow hole, the covering of earth over the back of the body being not more than eight inches deep. Further disturbance of the body was postponed until the medical examiner's arrival. He came upon the spot an hour and three-quarters later, and assisted in lifting the body from its shallow grave. It was fully clothed, the outer garments being in place and buttoned in proper order; the hat, a broad-brimmed felt with ostrich-feather trimming, considerably broken, lay under the girl's feet; the felt was neither cut nor torn. It was evident, however, that severe injuries had been inflicted upon the head, the hair being much matted and blood-stained and the cranial contour greatly altered. The body was rigid and cold. The elbows were flexed so that the right hand nearly touched the right shoulder, and the left hand appeared in the flexure of the right elbow, both hands thus appearing at the right side of the body.

It was obvious that a more thorough examination of the body was required than was practicable at that time and in that dark cellar by the light of a lantern; accordingly, after identification, it was removed to the City Hospital

autopsy-room, and the following morning, was made the subject of an autopsy. The clothing of the child was first examined. There was a blood-stain on the upper edge of the neck-band of the dress where it crossed the front of the neck. The drawers, of gray merino material, had been unbuttoned from the inner cotton waist on their left side; at the part of the drawers over the genitals the seams which came together here had been opened by breaking the stitches so that an orifice admitting three fingers was left. Careful search was made for any suspicious stains, but nothing was found to suggest either a seminal deposit or the marks of blood. In the seat of the drawers was a moderate fecal discharge, and around and behind this, the fabric was wet; later, the autopsy found the bladder empty.

The parts of the body which presented most medico-legal interest were the head, the neck, the external genitals and the stomach. Instead of detailing the autopsy according to the usual routine method, I shall ask the privilege of concentrating attention on these regions only, prefacing with the general statement that other parts presented nothing worthy of note in relation to this report.

Head. — The condition of this part can best be described by using the word "smashed." The skull was comminuted and lay in the scalp — a collection of larger or smaller bony fragments to the number of twenty-five. The effect of this extensive breaking was to change the shape of the head so that it was elongated from below upwards and resembled a fetal head delivered after cephalotripsy. The force of the violence was mainly in the frontal and left parietal regions, and there were ample external indications of the kind of traumatism which had wrought the mischief. There were four open, contused wounds, easily distinguishable in the regions above named. One of these extended obliquely across the forehead from the bridge of the nose to a point an inch above the middle of the right eyebrow; another was at the outer end of the left eyebrow; a third was in the left parietal region, and the last of the series was behind the upper part of the left ear, the edge of the ear itself showing in its broken and lacerated state that it had received a part of the force of the blow. To these should be added a contusion which was in the left temple, just above the zygoma; this had well-defined parallel edges, three-fourths of an inch apart and half an inch long. The edges of the various open lesions were irregular, ragged and contused; they were slightly parted. They varied in length from three and a quarter inches (on the left side of the head) to one inch (behind the left ear). In general course, they showed a parallelism which indicated that the blows were struck without change of position on the part of the assailant and his victim.

The effect of all this violence upon the parts beneath the surface can easily be appreciated. Out of the fissures in the skull and the wounds of the scalp and skin, blood and brain escaped freely and mingled in a matted mass in the hair. The left hemisphere of the brain was extensively disorganized, but at no point showed a clean cut or definite separate lesion. In the parts below the cortex, the brain substance of both hemispheres, such as retained some in-

tegrity, presented numerous punctate hemorrhages, especially marked in the ganglia at the base. The surface of the brain on the right side, which the blows did not involve, retained an unbroken appearance, but was freely blood-stained.

The weapon which caused these wounds and the manner of using it were clearly indicated. There was no difficulty in determining that repeated blows with a blunt instrument caused the fatal head injuries and of all such instruments an axe was the most probable. Such a weapon, indeed, had already been found on the floor of the stable in the cellar of which the body was buried. It was an ordinary axe of full size, showing long and rough previous use; its edge was dulled and its back part was irregular from much pounding. On the surface of the blade were reddish stains and in the eye, caught in the uneven wood of the handle-end, were three fine hairs of a light color. Both sides of the handle near the eye of the blade showed fresh scraping of the wood, but not deep enough to obliterate some suspiciously red stains in the natural seams and depressions. This important witness, found on the premises and so near the room of its habitual user, came into my possession when the girl's body was uncovered. I placed my initials on it for identification and took the earliest opportunity to deliver it, otherwise unchanged, into the hands of Dr. E. S. Wood and Dr. W. F. Whitney for their microscopic examination. It was obvious that it had some significant relations to the crime which destroyed the child's life; and it was plain that all the lesions on her head could be explained by blows with the posterior or hammer-end of its metal blade.

Neck. — Two inches below the left auditory meatus and a little behind its vertical line was a group of three marks — the upper, of about the size and shape of a grain of rye, having the appearance of a superficial abrasion; the second, just under this, a curved line a quarter of an inch long, with its concavity directed backward; and the third, below the second, a curved line, three-quarters of an inch long and with its concavity downward and backward. On the opposite side, midway between the auditory opening and the tip of the chin was another group of three superficial lesions of which the upper was a triangular abrasion of the skin, of the size and shape of a beech-nut; the middle a straight, oblique abrasion half an inch long, and the lower a curved indentation five-eighths of an inch long, with its concavity opening backwards. On the front of the neck, over the middle of the thyroid cartilage, was a transverse, superficial groove, with irregular edges, an inch and a half long, slightly parted and involving the thickness of the skin. From the left end of this ragged cut, there extended a broken but straight series of dots and spots toward the left sterno-mastoid; under this broken line there were numerous red dots, representing pressure from without applied through a fabric which had imprinted its texture upon the thin and delicate skin. Under this lesion on the front of the neck, the tissues were ecchymosed and infiltrated with blood, but there was no defined groove or desiccation. The larynx and trachea were not injured. In the left side of the neck, beneath the lesions noticed externally, there was much reddening and infiltration, giving the parts

a mottled aspect. This appearance, with the evidences of swelling in the same region, represented some form of external violence. What was it? It seemed to me to be due, without a question, to the application of a hand at the back of the child's neck for the purpose of drawing tightly upon the neck-band of her dress; the edge of this band, immediately over the transverse ragged cut in the skin was blood-stained. The direction of the curved marks on the left side of the neck and especially the backward opening of the crescent lines suggested a thumb-nail's pressure, for counter-extension or a point of leverage.

It should be added in this connection that the thoracic and abdominal organs were without the evidences of asphyxia. The cavities of the heart contained only a moderate supply of blood, of a florid color and fluid consistency. There were no sub-pericardial ecchymoses. The lungs were dry and pale, without any sub-pleural, punctate ecchymoses or peripheral emphysema. The bronchi were pale and empty. The spleen, liver, kidneys and mucous lining of the stomach and intestines were without any appearance of congestion.

Genitals. — The vulval region had the undeveloped aspect of chaste and innocent childhood; the deeper parts were wholly concealed within the external labia. There was no sign of injury about the groins, or the thighs, or the labia majora. The nates were smeared with a fecal discharge, and with this exception the region of the genitals upon a superficial inspection offered nothing noteworthy. Careful search for a seminal deposit was made, with negative results. It was not until the thighs were separated and the outer labia were parted that any sign of violence came into view; then the following appearances were observed: The mucous membrane of the vestibule, the ostium vaginæ and the fourchette was of a vivid red color, representing active irritation. The hymen was torn in three directions from a normal orifice situated somewhat anteriorly. The laceration took the form of a letter Y, the posterior rent extending well backwards and involving the edge of the fourchette; the anterior tears were shorter. The edges of the laceration were blood-stained and represented a lesion just before death. The opening made by this violent entry through the hymen was not large; it admitted the index finger of the examiner to the second joint. Upon internal examination, the vagina, a rudimentary passage of infantile size, showed along its posterior wall a distinct ecchymosis involving half the lumen and extending half-way to the os uteri; the mucous membrane was not wounded.

This vaginal lesion, taken in connection with the ruptured hymen and the marked irritation of the deeper parts of the vulva, left no doubt that a foreign body had made forcible entry. But the small size of the artificial vaginal orifice, the undeveloped anatomical structure of the organs forbidding the introduction of any comparatively large structure, compelled the conclusion that a finger, rather than a penis, had assailed the region and had caused all the injuries observed there. This conclusion was fortified by the negative results of a microscopic examination of the moist mucus of the vestibule and the vagina; this examination brought to view epithelial cells, bacteria and blood-globules,

but no spermatozoa. It is a subject of regret that the desirability of a microscopic examination of the material under Gilbert's forefinger-nail did not suggest itself seasonably; such an examination might have had startling corroborative fruits.

Stomach. — This organ possessed some interest with reference to the time of the death in its relation to the last meal. The child had dinner at half-past one o'clock; the dinner consisted of fried haddock, boiled potato, squash pie, bread and butter and milk or tea. She was last seen alive at or about half-past three o'clock the same afternoon. At the autopsy, the stomach contained five fluid-ounces of partly-digested, well disintegrated food, in which pultaceous mass, bits of potato, small, soft, yellow masses and minute fragments of curd-like consistency were distinguishable. What this gastric evidence indicated, when interpreted with the aid of a microscope, will be set before the Society in another connection. To my own mind, it was in entire harmony with other evidence relating to the time of the child's death, and gave to scientific research an excellent opportunity to prove its utility for judicial purposes.

Now, collating and analyzing these various data, what significance have they with reference to the purely medico-legal problem of the cause and manner of this child's death? I think they lead us to the following conclusions:

(1) The cause of the death was fracture of the skull and injury to the brain, resulting from repeated blows on the head.

(2) These blows were given with energetic force, the weapon or instrument being a heavy and blunt one like the corner of the poll of an axe.

(3) The immediate lethal influence was the stunning and killing shock resulting from the extensive disorganizing lesions of the brain substance; it was not hemorrhage, since the organs, though pale, were not exsanguine to a degree which fatal loss of blood would require.

(4) The situation and appearance of the forehead and scalp wounds suggested that they were received while the little girl lay on her back, with her face turned somewhat to the right shoulder, presenting the left side of the head to the blows of her assailant who stood over her facing the right parietal region.

(5) The condition of the neck showed strangulation to a degree but little short of fatal. The child was choked, but not choked to death, by the tightening of the neck-band of her dress; and the ragged groove in the skin where the edge of this band had cut through showed that the struggling had been severe in the attempts to escape. The nail-marks on the side of the neck were a part of the one act of strangulation and not a separate act.

(6) The vulval and vaginal injuries were proofs of digital violence. It was an indecent assault, not a rape. Sexual violence, if contemplated, was not consummated, although the lustful intent was manifest.

(7) The time of the tragedy was between two and three hours after the child's last meal.

Transposing these data, and weaving them into a reasonable hypothetical narrative of what transpired, the story runs like this. The little girl went

freely with her half-intoxicated comrade to see the place where he lived. Whether he enticed her may never be known. Whether the alcohol in his body permitted him to realize the nature of his actions may remain an impenetrable mystery. But the two, after a little exploration of the main floor of the stable descended to the dimly lighted cellar beneath. The man's heated blood craved sexual gratification and in a weak and cowardly yielding to temptation, he sought to gain this, first by libidinous manipulation of the child's vulva, meaning no doubt, to finish with an attempt at sexual intercourse. This indecent conduct on the part of the man, her friend and her father's friend, gave her physical pain and frightened her. In her distress and alarm, she tried to scream. Then her assailant began to appreciate what he was doing. Those calls for help meant discovery and disgrace; the child's cries must be stopped. Not meaning to destroy her, but only to silence her and to gain time, he seized her by the collar of her cloak and band of her dress, using his right hand at the back of her neck. The child tried vainly to cry out in her terror; she struggled with all her strength. Her assailant's grasp tightened to such a degree that the skin of her neck was cut. His lustful fury became uncontrollable. He choked his little struggling victim to syncope; then, dropping her limp body and seizing an axe near at hand, he gave full freedom to his passion and battered and smashed the head of the already half-dead child and so destroyed her life completely.

This is the picture which the imagination draws of what occurred that April afternoon in the cellar at Savin Hill. It is possible that some of the details of the sketch are somewhat visionary; but to the main scheme and motive of the tragedy, the proven facts lend themselves harmoniously. The weapon, the bloody spot in the sand of the cellar, the anatomical appearances of the girl's body and the condition of her clothing, the stains upon other clothing found on the premises where the homicide was committed, all these are realistic witnesses of this drama of unsatisfied lust and unbridled passion.

Let us turn for a moment from the deed to its imputed agent. What was Gilbert's demeanor after the homicide? All the testimony is concurrent that there was no observable material change from his usual manner. He joined in the search for the missing girl. He bestowed his maledictions on the person who had enticed her away or had harmed her. He attended to all his duties with fidelity and accuracy. He was open, calm and natural. He played "pool" in the afternoon of April 11th with his usual show of good fellowship. He kept an appointment with an acquaintance in the evening of April 10th and this man did not notice anything unusual about him. Immediately after the homicide, in the afternoon of April 10th, he reported with accuracy to his employer the several errands he had done for her that morning and the only unusual feature which she observed in his appearance or conduct was a flushed face and some evidence that he had been drinking, but nothing to suggest that within the previous hour he had been the principal actor in a murder of peculiar atrocity.

Then, three days later, when he was arrested, he was equally free from

agitation or incriminating behavior. His calmness and self-control did not forsake him. If he felt any burden of guilt, he was successful in concealing it from the trained observation of skilled detectives who, again and again, for more than twenty-four hours plied him with questions in their search for evidence. At first, he maintained an agnostic attitude toward the whole transaction, he knew nothing about it. Then, when in the unequal contest between himself alone and the various officers who were giving him a taste of the French method of police inquiry, he was told that he was the one who, in the detective's belief, had found the body of the girl and had buried it in the cellar, he replied with the utmost coolness, "If I admit that, how will it help me?" After a few hours alone and at night, he said with entire readiness that the officer's surmise was right, that going into the cellar on the morning of April 11th (the day after the murder) he saw the little girl lying on her back dead, that he was frightened and the thought possessed him that he would be charged with killing the child, and under the control of this fear he got a spade, dug a hole and buried her. When asked why he made the grave so shallow, his reply was that he intended to remove the body later. In immediate connection with this avowal, he went a step further and to the question, "What did you think?" he said, "I thought I had killed her, but I had no recollection of it. I had been drinking considerably that day." To a question whether he felt satisfied in his own mind that he had killed the little girl, although he did not remember it, his answer was in the affirmative. Finally, as a climax and conclusion of the police cross-examination, he made a long statement of his actions covering the interval from 8 A. M., April 10th, until his arrest in the afternoon of April 13th, and this statement was written as it was delivered and was signed by him as correct. Its peculiarity is the accurate memory which it represents of every detail of his conduct, including the burial of the child's body and the smearing of his trousers with her blood in that transaction; but of the really essential matter, the fact that he was with the girl and the period of time in which the murder was done, he uses only the following commonplace words: "Can remember of going around the sewerway to the stable and through it to my room. Had only been in there a short time when Mrs. Emmons [his employer] called me and I went to speak to her." In all these dramatic approaches to the central act of the crime, in all his answers to searching questions relating to it, he displayed a coolness and a candor which marked him as either an exceptionally skilful liar who could not be entrapped or as a victim of tragic circumstances, of the memory of which not a trace remained. Evidently, this extraordinary behavior makes the man a worthy subject for psychological study.

Another point in this connection is interesting. If we assume, as we must in the light of all the evidence, that Gilbert's hand destroyed the child's life, we cannot fail to be impressed by the brevity of this unplanned chapter of wickedness. The data for the determination of the time within which the various acts were performed, including the horrible consummation, are more definite than usual. The man with the girl in his company was seen going toward

the stable at 3.24 o'clock in the afternoon; this time is fixed by the arrival of a train according to its schedule at the Savin Hill railroad station; the two were then about five minutes' walk from the stable, and they were seen later going together in close proximity to that spot. It may fairly be stated that they entered the structure at half-past three. Gilbert responded to his employer's call and came out of his room very soon after four o'clock, certainly not later than ten minutes after four. And in that brief time of forty minutes, all the sad details of that homicide were accomplished.

The machinery of criminal jurisprudence in Massachusetts is very apt to move with a ponderous deliberation which has obvious disadvantages. The present instance, however, is an exception to the rule. The various steps in the judicial prosecution of Gilbert were accomplished with a celerity almost sensational. He was indicted for murder at a special session of the grand jury April 18th, five days after his arrest and eight days after the murder. His trial followed ten weeks later and a conviction of murder in the first degree came very promptly at its conclusion. The trial proceedings were marked by extraordinary smoothness and directness. The Commonwealth, represented by the honorable attorney-general and the assistant district-attorney for Suffolk, placed before the jury a well-ordered body of testimony which must have convinced even the prisoner that he was guilty. It certainly convinced his counsel, for no serious attempt was made to meet, deny or control it. Indeed in the conduct of the defence, the fact that Gilbert was the guilty agent of the child's murder was admitted, the contention being that he was irresponsible by reason of insanity. To this contention, the principal medico-legal interest of the case attached itself; and the medical propositions and opinions of physicians employed for the accused, with their rebuttal by other physicians in behalf of the Commonwealth, offered a new illustration of the prevailing barrister's methods of using medical experts. Into a consideration of the question of the defendant's insanity I have no purpose or desire to enter; that subject will be ably presented to the Society by another participant in the trial.

During the whole course of the trial, which like a great river in its normal channel, went forward quietly, implacably, bearing down all before it, the accused preserved an unmoved serenity. He was either a successful actor, able to conceal all emotion under a mask of the calmest indifference or his feelings were literally anesthetized or benumbed under a recognition of the situation in which he was placed. Not even the superb forensic eloquence of the attorney-general in his closing address or the dramatic denunciations hurled upon him by the dead girl's mother as she left the witness-stand, disturbed him. As he had conducted himself at the time of his arrest, so here, he was passive, patient, an enigma of stoicism.

The medical examiner's part in this trial was secondary. His main function was to narrate what he had seen and done. He had a grateful sense of the value of comprehensive memoranda of every detail of his observations and the lesson, long since learned, that full notes are better than the unaided memory

when the medical witness goes to court was again illustrated. The proper preservation and identification of all things relating to the case were also a source of contentment and helped the smooth progress of the trial. This very care, however, led to a singular incident which had the elements of embarrassment in it. The axe with which the murder was believed to have been committed had been marked by the medical examiner when he received it and had then passed from his custody into that of the experts in microscopy. When it was produced in court, the defendant's counsel asked, "Does that resemble the axe which came into your hands when the body was found?" Without pausing to consider the enigma how an object can "resemble" itself, the witness answered, "It does, inasmuch as it is the axe itself." The answer was objected to but was allowed by the court, as the only answer possible. Another question referring to the axe, this time asked by the attorney-general, suggested some of the snares which a witness is fortunate in escaping. The witness was asked if he had tried the axe in the several wounds to ascertain if they corresponded. The answer was in the negative and the witness had some satisfaction in the thought that his apparent neglect, or, more properly, his studied care to keep the weapon exactly as it was found, had spared him the need of explaining that the blood spots on it were not the result of his zeal in an unnecessary direction.

THE GILBERT MURDER TRIAL.

The Defendant's Mental Condition.[1]

BY GEORGE F. JELLY, M.D.

On the 16th of April last, I received a note from the district-attorney of Suffolk, asking me to commence to visit Angus D. Gilbert and to make a careful study of him. This was before the prisoner had been indicted by the Grand Jury or had had counsel assigned him. He had been arrested three days before (April 13th) charged with the murder of Alice M. Sterling.

On April 18th, I visited him, and told him that I came from the district-attorney to examine him, and to inquire into the condition of his mind and body; that I would like to ask him questions, but that he need not answer them or say anything to incriminate himself unless he was willing to do so. He replied that he was willing to answer questions.

He seemed intelligent, and made his replies quickly and with apparent clearness. He said that he was born in Nova Scotia, but had been in the States seven years; that he had been employed at Savin Hill, Dorchester, as general chore-man, and at the Savin Hill Station as assistant ticket-agent from 7 to 11.30 P. M. daily; that he had generally been in good health till he had suffered from *la grippe* last January or February, and had been pretty well from that time except that he had not had so good an appetite as formerly. (He also mentioned suffering from *la grippe* before the present year.)

On inquiry, I found that he had never been arrested before, but had taken liquor for at least four years, and to some excess for two years, often drinking eight or ten glasses of whiskey daily, and more or less beer. He had been drunk several times, but had generally planned to have some one substitute for him at the railroad station, when he went away on his sprees, and therefore had not lost his place. He had been drinking a good deal during the week before the day of his arrest, which was on Saturday, April 13th.

He stated that on the day the little girl disappeared, Wednesday, April 10th, he was in her father's barber shop about 2 P. M. She was there. The next thing he recollected was finding himself at the Savin Hill railroad station about 3 or perhaps 3.30; that when in the shop he was drunk; that he did not go into the depot, but went by; that he did not recollect how he got there but had a faint recollection of going from the depot, through what is called the sewer-way, up Denny Street, to the stable of the house where he had a room. He did recollect that his employer called to him and asked him what message he had brought from Boston, she having sent him there on an errand; that he went on and did his chores at the house as usual, ate his dinner, went

[1] Read at the meeting of the Society, October 2, 1895.

to the depot, and to Boston at 7.36 P. M., returning at 9.34 P. M.; that he drank while in the city; that he did his work as usual at the depot the rest of the night, went home and, he supposed, went to bed, as he found himself there in the morning but had no recollection of going home, and wondered how he reached there; that he did his usual work on the next day, Thursday, and on Friday, and drank a good deal on both days; that on Saturday, the day of his arrest, he did not drink much; that he had no recollection of having the little girl with him when he left the barber's shop, though the station agent and others, he admitted, said that they saw her with him. He said that on Thursday (April 11th) he went into the cellar of the stable about 9 A. M., and found the little girl dead, with blood on her head, and he buried her; that he buried her because he was afraid that he would be accused of murdering her.

I asked him if he thought that he might have killed her; and he said that he did not know, he could not tell, and added, "If I knew I killed her, I would say so." I said to him, "It puts you in a bad place." To which he replied, "Yes, I realize it," and added that he understood some man had said that he heard a noise about 9.30 P. M., Wednesday, and he said, "When I have counsel I will ask him to find him." I asked him if he knew of any occasions when he had done things of which he afterwards had no recollection; and he said that once, he thought about two months before, he had been told that he came out from Boston on the train at 11.30, that there was a girl on the cars who had a cloak and a gossamer, that he put the gossamer around her, and the cloak on himself, and went home with her, returning to the depot between 1 and 2 A. M., that a police officer spoke to him about this, but he had no recollection of it. He had been drinking freely at the time. On another occasion, he had met a girl, he said, and a fellow told him that he saw him talking with her. "When I saw her afterwards," he said, "she said that it seemed to her that I was a little off." Of this occurrence he had no recollection. He had been drinking. At another time, he took dinner at the house where he worked and then went to the station, but recollected nothing till he reached there. He was told that he ate not only his own dinner but also one ordered for one of the boarders, which he grabbed and ate with his fingers. Of all these things he was oblivious. He had been drinking to excess then. He was sure that he had never lost consciousness unless he was under the influence of liquor.

I asked him about the trains which came to the Savin Hill Station; and he gave the list and the time of arrival, from memory, accurately.

He said that he had had a good deal of intercourse with women, and had had venereal disease (chancre, clap and a bubo). He said that he slept and ate pretty well, and that he did not worry, because he did not kill the girl, though he buried her. He declared that if any one would testify that he saw her go into the barn with him, he would own that he committed the murder; that he suspected no one else, and that he would not throw suspicion upon any one, unless he had reason for it; that he could not see what motive he could have had for killing the child; that her father and he had always been

the best of friends. He recognized her by her dress, and was about to tell her father on Friday, the day before his arrest, that he had found and buried her, but concluded not to do so. He was not surprised when he was arrested. I asked him if he was more excited sexually when under the influence of liquor, and he thought not so much so, as he then generally wished to go away by himself and sleep.

A physical examination revealed nothing abnormal. His pulse at the close of my interview was 84, and seemed entirely normal, as did also the heart-sounds on auscultation.

At my second interview, which took place on April 28th, ten days after the first, I found him looking better. He recognized me at once. He said that he slept well, and that his appetite had improved since he had been in jail; he supposed this was owing to the fact that he had no liquor to drink. He again said that he did not worry about his situation, because he did not do the deed; that he had been drinking a good deal on Wednesday, the day of the murder, and had taken no breakfast. I went over very much the same ground with him as in my previous interview, and he gave substantially the same account of himself, varying in some particulars, which to me seemed important. While still denying any recollection of the child after leaving her father's shop at three o'clock or a little later, he admitted speaking to Mr. Burns on the doorstep outside of the shop (he told me accurately his residence) and something of the conversation between them. He still insisted that he knew nothing more till he reached the station, when he saw the station agent and waved his hand to him. From there, to the stable of the house where he worked, his account was clear; and he added that he took off his coat and sat in his room a few minutes before Mrs. E. called him. He reiterated his account of his doings during the remainder of the day, admitted that he drank more, and still claimed that he did not know when he reached his room that night, though he recollected leaving the depot to go home. He rose at 8 A. M., did his usual work, and at 9 A. M. found the little girl's body. He was much frightened at first and could not think. He buried the body before he went up stairs; he did not know why he did so, he "guessed" through fear.

He gave the same instances of the doing of things of which he afterwards had no recollection, and, in addition, the following: He was told, he said, that one night he went in town and came out, but he had no knowledge of it. I asked him if he were pretty drunk, and he said he must have been as he had been drinking. One day, two years ago, when he had taken a good deal of liquor, he went down cellar to freeze ice-cream; he lay down and went to sleep. When afterwards awakened by some one, he found the cream was frozen, but he had no recollection of having frozen it. On the same afternoon, he went for some cream, and the milkman told him afterwards that he was "whooping it" on the street. Mrs. E. had given him money to pay for the cream; he gave her the change and the next morning was about to do so again, when she told him that he had already paid her. On the same night he

went to the station as usual, but did not know how he got there. At the depot, he knew what he was doing but was "shaky."

I pressed him to recollect if there were any symptoms or peculiarities which he had noticed about himself; and he recalled that years before, at least five years ago, when not drinking, and before he ever acquired the habit of indulging in liquor, there were times when everything would look black, but he would not lose sight or consciousness. This condition would continue not more than a minute or two and would sometimes, not always, be followed by headache. He had had none of these periods for years. I questioned him as to whether he had had impulses to violence or to do anything out of the ordinary course which were beyond his control, and he was positive that there *never had been* anything of the kind.

He admitted, again, that the outlook was pretty black for him, but again said that he did not worry about it, as he was innocent of the crime. He said that he was told at the police station that the little girl was seen with him, but he still had no recollection of it, and added, "What do I want of little girls when there are so many big ones about?" and, "It seems so foolish of me to take the little girl to the station where every one knew me."

My third interview took place May 18th, about three weeks after the second. I found the prisoner much the same, and drew from him the same account of himself and of the periods when he had committed acts of which he claimed to be unconscious, but which he admitted were always done when under the influence of drink. His recollection of his doings on the afternoon of Wednesday, while at the barber's shop and immediately after leaving, was given more in detail each time and he seemed to recollect more that he did and said. For instance, he gave the time when he entered the shop as a little after two, and recalled looking at the clock; he recalled, also, that he leaned his head on his arm, went to sleep, and left the shop shortly after three, looking at the clock on coming out and noticing that it was ten or fifteen minutes past the hour. He mentioned the interview on the doorstep but still denied all recollection of everything else till he reached the depot. He gave more fully his conversation with Mrs. E. after he reached the stable, and what she said to him, and his replies. He had been to invite her cousin and his wife to come out to tea. He gave their message and told minutely where he went. He still stated that he remembered his walk from the station but could not recall some things that occurred that evening (for instance, taking his supper). He mentioned going in town, and, in addition, that he bought two lobsters, which he ate with a man named Sanborn at the main station in Boston. When I asked him (referring to his former statement) if he found the child the next day, he declined to answer. He said that he was arrested on Saturday, and remained at the police station till Monday; that a police commissioner and others questioned him from six or seven in the morning till twelve, except when they took him to the stable where the body was found; that he was surprised when he was arrested, and did not know why it was done till one of the police told him.

The Commonwealth's attorney asked Dr. Edward Cowles, of the McLean Hospital, and Dr. William A. Gorton, of the Butler Hospital, Providence, to associate themselves with me and examine the prisoner. We agreed to have no conference about him at all, till we had each seen him separately; and after each had formed an impression or opinion by himself, to confer together and then to examine him together.

We saw him together on June 22d. He seemed to talk as freely at this interview in regard to most things as when I had seen him alone, and described the gradual increase of his drinking habits for years, and said that for two years his indulgence in liquor had been more excessive; that he drank at the depot sometimes and once was so drunk that he slept out of doors all night. In addition to the other periods of unconsciousness which have been previously referred to, he told of a wedding at South Boston where there was a good deal of liquor and where he had taken a good many drinks; on this occasion he had lost all recollection he said, from the time that he was dancing with a girl till he found himself in a room upstairs and several people about him who said they had been looking for him for hours (he afterwards said "an hour"); that a friend and himself came in town that morning, took breakfast at the Temple House and then went home. He claimed he recollected nothing of this also, except going out of the room. He was asked again about his habits in regard to sexual intercourse, and admitted a good deal of indulgence both in houses of ill-fame and elsewhere. He said that he had gonorrhea two years ago, and a year ago, gonorrhea and a soft chancre, with a swelling in his groin; that Dr. L., of Dorchester, had called the sore he had on his penis a "soft chancre." He said that he had known the child four years and that she was eight years old, and expressed himself as perfectly willing to talk about the occurrences of the day when the child was killed. He said that he went to town at 10.33 in the morning, that Mrs. E. wanted him to go in with an order for dinner and to do an errand for her. He gave in detail an account of where he went, of what he purchased and of the time consumed. He told of drinking freely of whiskey and beer, at least eight or ten drinks, and of buying at the last saloon he visited a half-pint of whiskey in a bottle, which he put in his pocket. He did not recollect going out in the cars, but did remember going into the barber's shop and sitting down, and that Mr. Sterling was there, the man who worked for him, and little Alice; that it was ten or fifteen minutes past two when he went in and that he remained till ten or fifteen minutes past three. He supposed he must have gone to sleep or he would not have remained so long. He did not recollect speaking to Mr. Sterling or Alice, or that they spoke to him. He thought that Mr. Burns woke him by speaking to him, and again mentioned his conversation with him. He still claimed to recollect nothing more till he reached the station and saw the station agent; but he added that he saw two ladies and a gentleman waiting for a train. He gave rather more fully than before an account of his interview with Mrs. E. at the stable and of the events later in the day.

I asked him if he went downstairs the next morning, Thursday, and he

said that he did, and added very quickly, without being asked, that he did not see the child and that he did not bury her. I recalled to him the fact that he had admitted in two previous interviews that he had found and buried the child, and read to him from my notes what he had told me, almost in his own words; and he replied that what I said was true, and again insisted that he found nothing, and stated that he confessed finding and burying the body because he thought that they (meaning the authorities) were going to prove that he committed the crime anyway. A police inspector, he said, told him on Saturday, the day he was arrested, that he (the inspector) had known two men who had committed murder when under the influence of liquor who, when they came to themselves, had said, "My God! did I do that?" and had attempted to cover it up. Another officer, he said, told him nothing could make it any worse for him as they could trace the thing step by step. He said also that he had been questioned for hours by the police, from the chairman of the commissioners down; that he supposed nothing would help him, and that if he told any other story he would be subjected to another cross-examination by the officers and therefore he admitted what he did about finding and burying the body. He reiterated his denial and said that a lawyer had told him not to tell the story to any living person except his counsel. We asked him about the clothing he wore on the day the child disappeared, and he recollected having the clothing in his room on Thursday and that he wore the trousers on Tuesday, Wednesday and Thursday of that week. He had the nose-bleed and could account for the blood on his handkerchiefs and towels but not on the trousers and shoes. He saw a little blood on the front of the shirt and understood that there was blood on the arm which he did not see. He referred to a part of his statement to the police in which he said that in burying the body, he had turned it round and placed it face downward, and that he might in that way have got the blood on his clothing; and denied it as he had previously denied all knowledge of the child.

At this interview, he was again examined physically with some care. We found the heart and lungs normal, his pulse 84 and regular towards the end of the visit, which lasted two hours and fifty minutes; his knee-jerk was perhaps slightly exaggerated; there was no evidence of any trouble with his digestion or with any of the abdominal organs. His sight and hearing were good and sensation was normal.

Dr. Gorton in one of his examinations found an inequality of the pupils, but it was immediately removed by placing the prisoner in a position where the same amount of light entered each eye, and there was no permanent change in the size of the pupils. During my own interview I noticed no change in the pupils. He seemed to us all to be a man of ordinary intelligence, rather more intelligent, indeed, than the average man in his station in life. We took particular care to guard him against incriminating himself, unless he wished to do so and gave him abundant time to answer questions deliberately. He evidently realized his situation and was not the indifferent man which his counsel claimed. He saw the damaging effect of the admissions which he had

made at the time of his arrest and endeavored to take them back so far as he could, or to explain them away. He did not have the appearance of an emotional man, and had excellent self-control. He seemed to have a certain amount of confidence, that having had what he claimed were periods of unconsciousness in the past, when he committed acts of which he had no recollection, when drunk, he could prove that the murder of the child, if brought home to him, was done in a similar oblivious condition resulting from alcohol.

From an account given by his sister and from his counsel, we learned that one maternal uncle is incurably insane and has been in an insane hospital many years; that a maternal aunt was temporarily wrong mentally at the climacteric; that a maternal cousin had epilepsy and that two second cousins were idiotic. The prisoner's paternal grandfather is said to have taken liquor to excess, and his father, who is still living, we were told, could not be trusted to come to Boston to testify at the trial, on account of his drinking habits. While this shows a certain degree of heredity, it should be understood that this is all that could be found in all the generations of a large family connection, many of the families numbering eight or ten children; and it was very evident that on the occasion of the defence of this prisoner, all peculiarities in the family connection were made to count for as much as possible.

I have gone over the conversations with Gilbert at length and with perhaps tedious reiteration, because it seems to me that the successive interviews show that he unguardedly admitted more and more of his acts and of the occurrences at the time of the murder and of the period immediately following it, leaving a suspicion, amounting almost to a certainty in the minds of the physicians who examined him, that he was not telling the whole truth, and that he was not oblivious of any of his acts. He denied, at first, all recollection of anything from the time he left the barber's shop till he reached the depot, and said that he had only an indistinct remembrance of how he went from the station to his room. He afterwards admitted talking with Mr. Burns on the doorstep of the shop. He described minutely what he saw at the depot and gave a clear account of how he went to his room and what he did and said on his arrival there and immediately after, and at each interview gave a little fuller history of his movements. He recollected, finally, everything of importance except the most important fact that the little girl was with him and that during the greater portion of the walk from her father's shop to the stable she had her hand in his; — facts which were abundantly proved by several witnesses who knew them both and by whom they were traced till within a few feet of the stable door, after which she was never seen alive. He, however, never claimed that unconsciousness occurred at times other than when he was drunk. Under pressure at the time of his arrest, he admitted finding and burying her body. At our last interview it was evident that he realized himself that he had said too much or had been so told by his counsel, as he endeavored to take it back, showing to our minds that he recognized the importance of this admission in its telling force against himself.

After endeavoring to give the prisoner the benefit of every doubt, and after

carefully weighing his history, his symptoms and appearance, and without allowing ourselves to be influenced by interviews with the attorney-general or district-attorney, Dr. Cowles, Dr. Gorton and myself gave an opinion that Gilbert was not insane at the time of the homicide, but that he committed the act while under the influence of liquor; and further, that he was not insane at the time of his trial.

He was tried in June last, the proceedings occupying four days. We were not called upon to testify until we had heard all the testimony, on both sides; and we heard nothing to change our opinion of the prisoner's mental condition. His counsel admitted to the jury that Alice M. Sterling was murdered and that Gilbert killed her. They claimed that he was insane at the time of the homicide and introduced many witnesses, some who had known him from his boyhood and who were acquainted with his antecedents and family. These witnesses testified to peculiarities, but to nothing which seemed really the symptoms of insanity and it was evident that he had never been considered insane till he committed the homicide. There was a good deal of testimony showing that he had been a good-natured, easy-going man, not quarrelsome or revengeful. All his intimate acquaintances testified that he indulged in liquor, though the effort of his counsel was to minimize his drinking and to bring into prominence his peculiarities. His associate at the railroad station testified that he did his work intelligently and well, except at those times when he was under the influence of liquor and then some one else was required to perform his duties.

I talked with his employer (Mrs. E.) in regard to him and she said that he had done his work at her house very well as a rule, and that he was kind and obliging. She had seen him drunk several times and had warned him that the offence must not be repeated. She knew when the child was reported to have disappeared but had no suspicion that Gilbert had had anything to do with it, and was much surprised when the girl was traced to her house and he was arrested. She had never seen anything in him during the years in which she had employed him that suggested that he was insane, and spoke particularly of the accuracy of his memory.

As it had been intimated that the defence would claim that Gilbert was suffering from epilepsy and that the crime was committed while he was in an unconscious condition, or under the influence of an uncontrollable or automatic influence resulting from an epileptic seizure, my associates and myself, in all our interviews with the prisoner, laid especial stress upon any evidence of unconscious or automatic acts which he might have committed; but we failed to find any such occurrences except when he was thoroughly under the influence of liquor; and the trial gave us no further knowledge. I believe that I am right in stating that a case of epilepsy never existed which depended solely for its manifestation upon drunkenness and was never seen nor suspected at any other time.

If we admit Gilbert's claim that he had no recollection of having the child with him after he left her father's shop, or of committing the homicide, and that his forgetfulness arose from the effects of an epileptic attack, he must

have been under that influence during the whole of the walk from the shop to the stable, and it is entirely inconsistent with epileptic unconsciousness or automatism, that he should recall so much which did occur and have no knowledge of the important facts that the little girl was with him and that he murdered her. The defence, however, merely hinted at epilepsy and endeavored to prove that the defendant came into the world with a marked insane heredity, that he had exhibited symptoms of unsoundness of mind for years, even before he left Nova Scotia, and that, finally, indulgence in liquor, acting upon a weakened intellect, deprived him of all self-control and led him, under an impulse which he could not resist, to commit the murder. Much of this theory was refuted by the cross-examination of the defendant's own witnesses.

The defence introduced two physicians, one of whom testified that he did not think the prisoner insane, but believed him irresponsible; and the other gave it as his opinion that he was of unsound mind and was suffering from "homicidal impulse."

The intelligence and good memory which were manifested by the prisoner when he was visited, and which led his counsel to consult him very frequently during his trial, did not indicate that he was suffering from mental weakness or dementia.

While such a thing as a homicidal impulse is not uncommon, it is a symptom of mental disease and not a disease itself; and, standing alone, with no other evidence of unsoundness, must be open to grave doubt, especially in the case of a criminal.

That Gilbert's homicidal act was the sudden, uncontrollable, motiveless outburst of transitory mania, is not probable, as it was manifested when he was proved to be thoroughly under the influence of drink; and sufficient motive was furnished in the fear of the detection of the crime which he had already committed — the attempted rape of his victim.

Something has been written about the automatism of the acts of a man when he is drunk as a defence for a crime which he may commit. I think that this has not the sanction of good authority, is very dangerous ground, and certainly would not be admitted by the courts. It would be excluded in Gilbert's case for very much the same reasons which exclude epilepsy — his admission of recollection of acts and events just before, at the time of, and immediately after the homicide.

It seems to me probable in the light of all the evidence, that Gilbert took the child to the stable for indecent purposes; that she resisted him and perhaps made a noise or threatened to tell what he had attempted to do, and that fearing detection, he killed and buried her; that though under the influence of liquor he knew what he was doing at the time and recollected it afterwards. This was the theory of the Government — I do not myself believe that he intended to commit murder when he entered the stable, or that he would have done so if he had not been drinking heavily.[2]

[2] Since the reading of this paper, Gilbert's counsel have argued exceptions before the Supreme Court, the exceptions have been overruled, and the prisoner has been sentenced to be hanged.

THE GILBERT MURDER TRIAL.

The Microscope as a Witness.[1]

BY W. F. WHITNEY, M.D.

These examinations, which I had an opportunity of making, in association with Prof. Edward S. Wood, covered as wide a range of subjects as often occurs in a single case.

Their object was to show:

(1) The constituents of the victim's last meal from the contents of the stomach; and from the stage of digestion, how long after its ingestion she had been killed.

(2) The nature of stains upon an axe, on the defendant's clothing and shoes, and on objects found at the spot where the murder was supposed to have been committed.

(3) The identification of hairs found sticking to the axe and to one of the shoes.

The subjects will be taken up in this order and it will be shown what could be proved.

CONTENTS OF THE STOMACH.

This consisted of about five and one-half ounces of opaque fluid, mixed with soft, whitish lumps and irregular fragments, varying in size from a minute point to that of the end of the finger. Intermingled with these were small bits of a bright-yellow color. The appearance of the former suggested potato, and of the latter squash or pumpkin. Closer examination revealed a greasy look to the fluid. In addition to the larger white pieces, smaller, firmer, flaky ones were detected.

Microscopic examination showed the white, soft pieces to be composed of large, rather shrivelled cells with a granular contents staining blue with iodine. This taken in connection with the gross appearance left little doubt that the substance was potato.

The yellow fragments were made up of vegetable cells of a large size containing round yellow granules. Comparison showed these to be identical in structure with those found in cooked squash.

The firmer, flaky bits were found to be masses of very finely striated muscular fibres, which though much broken up, were evidently originally short and flattened. The diameter varied from $\frac{17}{6000}$ to $\frac{54}{6000}$ of an inch, average $\frac{36}{6000}$ or $\frac{1}{230}$ of an inch. A comparison was made with pieces of fried haddock; and the general appearance of the flattened fibres measuring from $\frac{22}{6000}$ to $\frac{80}{6000}$, average $\frac{50}{6000}$ or $\frac{1}{120}$ of an inch, was identical with fine striations.

[1] Read at the meeting of the Society, October 2, 1895.

Roast-beef fibres were found to be round, quite long, and much finer with relatively coarse striations, measuring from $\frac{5}{6000}$ to $\frac{24}{6000}$, average $\frac{16}{6000}$ or $\frac{1}{400}$ of an inch.

Roast chicken was similar to beef in its long round fibres, the striations were still coarser, and the thickness still less, the diameter being from $\frac{6}{6000}$ to $\frac{18}{6000}$, average $\frac{12}{6000}$ or $\frac{1}{500}$ of an inch.

There was no doubt, therefore, that the muscular substance found in the contents of the stomach was fish, partly digested, as shown by the narrower fibres; for the gastric juice must act on the thickness as well as on the length of the fibres.

It is thus evident that a distinction can be made between the muscular substance of fish, meat and fowl, if digestion is not too far advanced; but whether any finer distinction of these classes among themselves can be made out, is a subject for future inquiry. It did not enter into this case, however.

In addition to the above, there was present a quantity of free starch granules, shown by the iodine reaction, some of large size and others quite small and united in clumps. The former probably were the potato, and the latter wheat starch.

Free fat was present in the form of finely divided droplets, staining black with osmic acid.

These two reactions could be made on the same preparation, first adding a drop of liquor iodini compositus and then a drop of one per-cent. solution of osmic acid to a drop of the fluid on a slide, and then placing a cover-glass over. In this way, the fine granules of starch could be clearly differentiated from the minute drops of fat, while this is not always easy in an unstained preparation, even for a practised eye. This reaction took place equally well after the specimen had been preserved for two months, by placing an uncorked bottle of chloroform in the tightly closed, wide-mouthed jar that contained the contents of the stomach. The vapor of the chloroform prevented any putrefactive change; the only precaution necessary being to refill the smaller bottle from time to time.

The inference from the above examination was that the little girl's last meal consisted of fish, potato, squash in some form, and something made from wheat flour (bread or pastry) and fatty substances (butter, milk, etc.).

At the trial, her father testified that the dinner which he prepared for her and her brother at one o'clock on the day she disappeared was haddock, potatoes warmed over, squash pie and mince pie, and she had also a cup of milk. Her father did not dine with her, but saw her again at two o'clock, so that the last time she was known to have eaten was between those hours.

The amount found at the autopsy (five and one-half ounces) in the stomach, would be less than half of what a child of her age (eight years) would take at a meal (one pint). But as the greater part is fluid, which is quickly absorbed or passed down, this does not prove that digestion was more than half completed, while the relatively intact condition of the more solid portions point to a comparatively early period. From these data, it was concluded that the

child had been killed from two to two and a half hours after her last meal, that is, between 3.30 and 4 o'clock.

The last time she was seen alive was at 3.30 P. M., on Wednesday, April 10, 1895, with the defendant, and he was again seen at about 4.10 P. M., that is, forty minutes later.

STAINS.

A number of articles on which were suspected stains, were submitted for examination. These were an axe, a shirt, a pair of trousers, a pair of russet shoes, five handkerchiefs, two towels, a piece of a log, dirt from the cellar floor, and a piece of a hat feather.

All the stains were first examined with the eye and a hand-lens. Their position on the object was located and their general shape, color and peculiarities noted. The most important were then examined, chemically and microscopically.

The first consisted in making Teichmann's test for producing hæmin crystals, and was done as follows: A minute fragment was scraped from the spot with the point of a sharp knife, placed in a drop of distilled water on a glass microscope slide, and stirred about with a finely pointed glass rod. If blood was present a distinct reddish tinge was imparted to the water after a longer or shorter time. To this a minute crystal of potassic iodide was added and allowed to dissolve. The slide was then carefully heated over a small flame until the drop was *absolutely* dry. When blood-coloring matter was present, a little cloudiness of the fluid appeared after the heat was first applied, due to the coagulation of the albumin (albumin test). A cover-glass was placed over the dried spot and a drop of *glacial* acetic acid run under, and the slide was again heated as before, very carefully, until bubbles appeared under the cover-glass. As Dr. Wood has pointed out, the crystals are very apt to be carried by the bubbling over the edge of the cover-glass and deposited on its upper side, or on the slide beyond it. The preparation was examined at once and then set aside to dry, and again looked at after the addition of a drop of water to dissolve the crystals. The presence of blood was positively shown by the formation of minute garnet-red, rhombic crystals, often united in a cross.

The preparations for the determination of the kind of blood, whether from a mammal or not, and for the measurement of the corpuscles, were made. The minutest possible fragments, scraped with the point of a sharp knife from the thinnest parts of the stain, were placed on a slide in the centre of a circle about half an inch in diameter, surrounded by a narrow ring of Bell's cement. [These "ringed" slides were prepared beforehand by tracing out the circles with a small brush dipped in the cement, while the slide was rapidly revolved on a turn-table, and then setting them aside to dry.] To these was added a drop of a solution of acetate of potassium of a specific gravity of 1.028, with each ounce of which a few drops of a saturated solution of chloral hydrate had been mixed to prevent the formation of mold. The specimen

was then covered with a No. 1 round cover-glass, and after the edges were carefully wiped, it was sealed on the turn-table with the same cement. After this was thoroughly dry (twelve to twenty-four hours) they were examined with moderate dry and high immersion lens. The oil could be removed from the cover-glass by wiping it off carefully with xylol, which does not affect the cement if not allowed to stay too long in contact with it.

The Axe. — Stains were found on each side of the head of the axe and in the cracks between the handle and the head, both where it entered and where it passed out through it. Just below the head, the handle had been freshly scraped, but in the natural indentations of the wood a reddish material was found. In all of these, the presence of blood was shown by the chemical test, and clots of mammalian blood were easily recognized with a low power. On examination with the high power (Zeiss, 2 mm. horn oil Immers.) 207 corpuscles were found that could be measured, with extremes of $\frac{1}{3300}$ and $\frac{1}{3900}$ of an inch, and an average of about $\frac{1}{3300}$ of an inch, which is consistent with the limits assigned to the size of human blood-corpuscles.

The stains were most abundant on the posterior half of the head of the axe, which was in accordance with that part having been used to deal the blows. The nature of the wounds on the head showed that they had been made by some blunt instrument. There was only a single spatter on the axe that in any way indicated direction; it was an elongated pear-shaped one with the stem pointing towards the back. If it came from a spurt of blood, it would show the edge had been used. But it may have been a drop which fell on the blade while directed downward, and thus would bring the bulk of the drop farthest away from the place where it fell. Several hairs, to be described later, were found sticking to the axe; but although a careful search was made, no brain substance was found anywhere on it.

The Trousers which had been worn by the defendant on the day of the murder and were found hanging in his room by the police officers were an ordinary pair of rather light-gray woollen ones. They were very much soiled and worn, but showed a number of stains which proved to be blood. The clots removed showed clearly the characteristics of mammalian blood, but there were very few corpuscles that could be measured. In one of the largest stains on the inside of the left leg, below the knee, was a little yellowish-white substance mixed with blood. A fragment of this, mounted as before, showed that it was cellular tissue and in one bit was a piece of a capillary filled with blood-corpuscles. One peculiarity of this substance was, that after it had been in contact with the fluid, in which it was mounted, for a few minutes, little pear-shaped and thread-like masses, clubbed at the end, were seen under the microscope to project from all sides of it. These were structureless and had a peculiar high refraction. It was thought by both of us to be the myeline of the brain nerves, which is not retained by the sheath of Schwann, as in the peripheral nerves. In confirmation of this, a portion of a child's brain was dried upon cloth, and a fragment scraped off gave the same peculiar picture of the welling out of the myeline in clubbed threads and pear-shaped

masses. This took place after a month although not as quickly as at first. It is a point for the identification which is quite characteristic. At least none of the ordinary fats or cheese, that I have tried, act in this way, and these from their gross appearance might be mistaken for it.

Very little is said in the text-books about brain substance, the only reference which I can find being by Hofmann.[2] In his case, the presence of ganglion cells and the abundant plexus of capillary vessels enabled a diagnosis to be made. No reference was made by him, however, to this peculiar appearance of the myeline.

The distribution of the stains upon the trousers was interesting. They were chiefly on the inner side of the left leg from the crotch down, except in the region of the knee. The only one showing direction was that in which the brain substance was found. This was below the knee and its long axis was at right angles to that of the leg. There were two very small stains at the upper part on the inside of the right leg, and quite a number just above the bottom. On the outside of both legs the stains were grouped close under the knees and near the bottom. Direction was only indicated in some of the lowest on the right side, and in general was at right angles to the long axis of the leg.

The prisoner had apparently not observed these spots, and when told of their existence explained them by his having brushed past the body at the time he found the dead girl and buried her. This might explain a few of the lowest ones; but their number and position are more consistent with their having come from handling a recently killed person, from whom the blood could easily drip, than in one that had been dead fifteen hours, for then the clots would be dry and firm.

Although in his statement to the officers he denied having handled the body while kneeling; still the spots on the *inside* of the left leg, above and below the knee, are best explained as coming from the recently killed girl while he was kneeling on the right knee with the left foot on the ground and the leg at a right angle. The stains on the outside of both legs just below the knee and close to the bottom may have come from his own hands. For any one can easily satisfy himself that they would naturally come in contact with those parts of the trousers, by assuming the position described above. It is to be hoped that something may yet come out that will prove whether this assumption is correct.

It is a curious fact that neither the color of the trousers nor the location of the stains was correctly stated by a single witness who had seen them before they came into our hands.

Shirt. — The only important stains were two minute ones on the wristband close to the button-hole and having a direction from without inwards. They were evidently spatters from a falling or projected droplet of blood, as the stem of the pear-shaped stain pointed inwards. It required a strong pocket lens to make this out, as they were very small. Microscopic examination

[2] Hofmann: Lehrbuch der Gerichtlichen Medicin, Zweite Auflage, Wien, 1881, page 410.

showed it to be mammalian blood, and as far as the measurements of a few corpuscles were of value, consistent with human blood.

Shoes. — On a pair of russet laced-shoes, were numerous stains, some of which looked like spatters; and in one of these mammalian blood, with corpuscles consistent with those of man, were detected. Otherwise the shoes were very clean, so much so in fact, that we regarded it as impossible that they could have been worn when digging the grave, in which the body was found buried. This corroborated his statement, made to the police, that he did not wear them on that day. The stains, therefore, must antedate that time. It was evidently important to connect them in some way with the dead body, but all that could be found was a single hair, to be described later, in a mass of dried mucus-like material on the sole of the shoe.

Towels and Handkerchiefs. — These were found in his room and on his person, and were stained with blood as appeared to the eye, and as was proved by microscopic examination. Beyond this, little of value was gained; and the defendant's statement that they came from a nose-bleed could not be disproved. One of the towels looked as if it had been stained by rubbing blood from some other article, as it was smooched rather than stained or spattered.

Earth, Feather and a Piece of Brown Paper, from the floor of the barn, showed clots and stains of mammalian blood, but so poorly preserved that the corpuscles could not be measured.

A Piece of Log lying on the barn floor was found covered with dark brown stains and spatters. Their color pointed to considerable age, and the microscope showed clots composed of oval nucleated corpuscles, similar to those of oviparous animals (fowls, reptiles, etc.). In all probability the block had been used in decapitating chickens at some time.

The possibility of distinguishing between the blood of birds and that of man was again demonstrated in this case, as it has been before.

Hair. — The identification of the hairs was no less interesting and important than in many other cases. It served to connect the axe with the murdered child, thus aiding in proving that it was the instrument with which the deed was done.

There were three fragments of light blonde hair sticking to the handle where it projected beyond the head of the axe. They measured on an average $\frac{1}{375}$, $\frac{1}{450}$, $\frac{1}{485}$ of an inch in diameter. Two were without a medullary cavity and one had a narrow, interrupted one. Two others were found where the wooden wedge was driven into the handle. They were similar non-medullated, and each measured on the average $\frac{1}{480}$ of an inch. All the above were fragments and varied in length between $\frac{3}{4}$ and $1\frac{5}{8}$ inches. An entire hair one inch long, $\frac{1}{550}$ of an inch in diameter, without medulla, was also found here. On the shoe were found two hairs, one and one and one-half inches in length; one a fragment, light blonde, without medulla, averaging $\frac{1}{400}$ of an inch in diameter, and the other an entire hair, rather darker, with a rounded end, measuring $\frac{1}{375}$ of an inch in diameter.

All the above, with the exception of the last, were similar to those taken *post-mortem* from the head of the murdered girl. These were of a light blonde color, and measured between $\frac{1}{300}$ and $\frac{1}{333}$ of an inch in diameter, giving an average of $\frac{1}{317}$ of an inch. Many of the hairs also had an interrupted, fine, medullary cavity.

The value of the different pieces of evidence thus obtained may be summed up as follows:

The presence of human blood alone upon the clothing could be explained as coming from a copious nose-bleed. But the association with brain substance in one of the stains, served to connect them most closely with the victim; while the number and size were not consistent with what would have been made by contact with the body fifteen hours after death.

The blood on the axe was shown to be from the victim, as hair consistent with hers was found sticking in it.

The contents of the stomach were the same as her last meal, only half digested. Thus the time of her death was fixed very closely to that when she was last seen with the defendant. This evidence was so strong that practically no attempt was made by the defence to overthrow it.

DISCUSSION.

The reading of the three papers relating to the Gilbert murder trial elicited the following comments:

DR. HOUGH: I should like to ask Dr. Whitney the limits of time during which the myeline reaction can be obtained.

DR. WHITNEY: The longest limit I found was one month. Yesterday I tried for the reaction in this case, now five months since the murder, and there was no indication of it.

DR. HOUGH: Did the spots on the left of the trousers leg look as if they could have been done with the hand?

DR. WHITNEY: Some were small and not very conspicuous, and only one sufficiently well-marked to give indication of direction, and that was transverse to the long axis of the leg. It looked more as though the blood had been projected and had fallen in this direction. It seemed to point to blood which was certainly very fluid or that had been spurted or thrown out from a spurter — that is, very fresh blood.

DR. HOUGH: I should like to ask if as yet you can identify human blood as distinguished from dog's blood.

DR. WHITNEY: You cannot make an absolute identification and say, "This is human blood." But you can say, "This is consistent with human blood."

DR. BRONSON: I should like to inquire if the defence did not introduce expert testimony to show that the prisoner at the bar was innocent, basing their view of that matter upon the law of heredity?

DR. JELLY: Testimony of that kind was introduced to prove that the man was innocent, and that the influence of heredity was claimed. In my paper I called attention to the amount of heredity which they brought forward, namely, one paternal uncle, one maternal aunt temporarily insane, one case of epilepsy in a cousin, and two idiotic children second cousins. That was all that could be found going back several generations, and some of the families numbered ten children.

DR. ABBOTT: Gilbert stated that he buried the body because he feared that he might be accused of murdering the girl. Now was this suggested to him by the defendant's counsel? And, also, was the theory of the loss of consciousness suggested by the counsel?

DR. JELLY: At my first interview, he had not had counsel. From what he said afterwards, it seemed to have been suggested to him by the remark of a police inspector who told him he had known several men who had committed murder when under the influence of liquor; and afterwards had said, "My God, did I do that?" and, had claimed to be unconscious. I put that statement, with the statement at the third interview, as his motive for dwelling on the unconsciousness. I was anxious to find if there was anything like epilepsy. I thought he was rather more intelligent than men in his social position.

DR. DOLAN: I should like to ask whose property the axe in this case was considered to be, whether it is supposed to be the property of the medical examiner or that of the police. In a case which came under my notice recently I claimed that the instrument used was the property of the medical examiner.

DR. HOUGH: I think that is a matter which is settled by courtesy between the police department and the medical examiner. I have had occasion once or twice to know something about that thing, and we never had any trouble in New Bedford. The idea that animates both parties is to find out about the weapon in question as quickly as possible, and it is sealed up and sent to Professor Wood. I know that in some other parts of the State the same thing is done. I do not think there is a legal question about it or that it has been settled definitely. I would like to inquire what are the limits of time in regard to digestion. How near can you tell as to how many hours after a meal a person dies? The matter came up in this case, and I have known of its coming up in other cases, but I have not heard a statement as to the accuracy with which this may be determined.

DR. WHITNEY: I think it is only approximate; it must be a matter of individual judgment. It must be a matter of inference in the particular case. I think there is no absolute hard-and-fast line by which you can judge from the appearance of the contents of the stomach within a few minutes or within even a half-hour of time, but you can make a good approximate estimate.

DR. HOUGH: That is what I want to get at, what are the limits of accuracy? Can you judge within half an hour, an hour, two hours or within six hours?

DR. WHITNEY: I think within an hour. But we must consider each case by itself.

DR. BRONSON: I have in mind a case in which a person will take a light supper at six o'clock and for about six hours regurgitation of food occurs with no change of taste. Then regurgitation ceases and he has a good night's rest, no repetition of it until after breakfast. He is a man in good health, and I regard it as a case of slow digestion. Now, if he should meet his death by foul play or in any other way suddenly and his body was to be examined, that law would be entirely inapplicable to his case. I suppose there are a good many exceptions to the ordinary rule without regarding a person as in a pathological state.

DR. WHITNEY: Do you mean that he vomits his food?

DR. BRONSON: No; I mean throwing up of the contents of the stomach into the throat or mouth. It comes into the mouth without change of taste and is re-masticated. I have not examined the food. His appetite is not impaired. He performs the ordinary functions of life.

DR. WILLIS: I suppose the mental condition of the person after taking the meal would have a considerable influence. I have in mind a case which illustrates that point. A boy in good health with vigorous digestion had taken a hearty meal. A few minutes after, he fell quite a distance from a tree, and was considerably hurt. He was brought to his home some twenty-five miles in the cars. After coming home, it seemed necessary to etherize him to dress his wound properly. While under the influence of ether, some five hours after taking food, he vomited food some of which was drawn into the trachea, and he died almost immediately. On examination the food was found to be scarcely at all digested and very nearly in the condition in which it was taken; but he had been under the mental disturbance of the fall, and had been suffering pain.

DR. WHITNEY: As he received the accident almost immediately after the food was taken you would hardly call the digestion normal. I think each case must be considered by itself to see exactly what the conditions are, but I think it is fair that the conditions should be known.

DR. SMITH: I should like to say a word in connection with this matter of determining the period of digestion. I wish Dr. Draper had said something bearing upon the point with reference to the amount of partially digested food in the small intestine so that you might have a comparison between the amount of chyme in the duodenum and in the stomach. My attention has been called a number of times to the great difficulty of determining the approximate digestion, because, as Dr. Whitney has put it, it is only a matter of approximation. In a recent murder trial in my own State [Maine], I had occasion to try to determine this question, and I realized forcibly, what I think will be admitted by all of us who have attempted to do anything in this particular line, that we have nothing at present from medical jurisprudence which gives us any information bearing upon this particular point. We are forced back to what information we can get from our best authorities on physiology; and when we consider, as Dr. Whitney has intimated, that the digestion of every individual will depend a good deal upon the rapidity of peristalsis, the degree of mastica-

tion of the food, the character of the food itself, the character of the food so far as its degree of cooking is concerned, we have to admit that we may be obliged to go into court and state that that is simply an opinion according to our own judgment. It seems to me from my study of the question, particularly in the case to which I referred, that some evidence can be gained by a comparison between the amount of chyme in the duodenum and that in the stomach as well as a comparison between the digested, macerated condition and the changed condition of the food in each of those cavities. It seems to me also that societies like this which have for their object the discussion of medico-legal points are now having a great opportunity to render valuable service bearing upon this particular point. Whenever they are able, as they are in many cases, to fix the exact time of killing by undoubted evidence after the known time of taking food, the character of food and (when they are able to learn them) the particular habits of the individual, valuable evidence may be obtained. In the case to which I refer, it was found that there were conditions which must undoubtedly have interfered with normal digestion, because microscopic examination of the kidneys showed that the man had an advanced condition of renal disease; he had also a mild degree of gastritis. He was an habitual hard-cider drinker. He had also defective molar teeth, and these things taken into consideration would justify one in giving him a little longer time for digestion than in the case of an ordinary individual. Of course, when we come to the question of the physiology of digestion, we are obliged to admit that all the statements of our authorities on physiology upon this subject are only approximate. We know that certain foods undergo certain chemical changes and that an average period is required for those changes to take place. We know the average time the food remains in the stomach. We do not know anything more than that. We have not yet arrived at any way of determining it positively with reference to any particular individual. In answer to Dr. Hough's question as to the limit of time, which is really the thing we are after in these cases, I should be inclined to agree with Dr. Whitney's answer that we could certainly get down to an hour, and if we found an individual whose viscera were normal, teeth sound, and who had taken easily digested food, I do not think I should hesitate to figure it down to a half-hour.

Dr. Perry: I should like to ask Dr. Whitney, inasmuch as nothing has been said in regard to the character of the food ingested, whether the general rules applied to the digestion of various kinds of food would apply in this or in any case, that is, the time required would make any special difference in determining the approximate time of death. Suppose a man had taken a hearty dinner of pork and beans and another a dinner of easily digested food, would you make the same allowance that you would thinking that the one required a greater amount of time to digest than the other? If it requires four hours to digest beef and two to digest soft-boiled egg, and a man is killed after taking beef and another after taking egg, would the relative difference between the times required for digestion be the same; that is, if the men were killed

four hours after taking one and two hours after taking the other, would the state of digestion be the same?

DR. WHITNEY: I suppose it would, if I understand what you mean. If it ordinarily takes two hours to digest and you find the food half-digested, you would assume that the death occurred an hour before.

DR. ADAMS: It seems to me that a very important point, touched upon by Dr. Smith, is the condition of the teeth and the fineness of the food.

HOMICIDE WITHOUT EXTERNAL MARKS OF VIOLENCE.[1]

BY S. D. PRESBREY, M.D., OF TAUNTON,
Medical Examiner.

On Monday, February 11, 1895, I was summoned to North Easton to view the body of John Johnson, 3d, who was found dead in bed at his boarding-house on that morning. The deceased was a Swede, unmarried, twenty-four years of age. The family in which he boarded was Swedish, and the history was obtained through the woman of the house, who spoke English fairly well, but had had but little experience in interpreting testimony.

Johnson had spent the day before, Sunday, with his companions, in drinking to considerable excess, and had finished the day in a saloon, where he was still drinking at 7.30. In the saloon the Swedes met a party of young Irishmen, and between the two nationalities there appeared to have been a feud which led to a quarrel, and after leaving the saloon while upon the street some one hit Johnson with a "board." Johnson did not fall, but the combatants dispersed, and Johnson with his companions walked along, and his friends left him sitting upon the porch of his boarding-house. The next known of Johnson, he was found in the out-house, unconscious and apparently sleeping. He was taken to his room and placed upon the bed, where he remained in a snoring sleep. He was seen at 3 A. M., and was still snoring. At 6 A. M. he was found dead in bed. An old Derby hat with the brim on the left side broken, was shown, and it was said to be the hat he wore the day before. There was a little bloody froth about the nose and mouth, and a soft, dark dejection was in his clothes. The pupils were of medium size and apparently equal. The most thorough search failed to show any mark of violence on the body. The head was carefully studied, but nothing suggesting a blow could be found.

Under the circumstances, I was of the opinion that the cause of death was the large amount of alcohol that he had taken during the day and evening, and I accordingly made out my report "alcohol poisoning," and hence I did not feel that it was my duty to make an autopsy, and the body in due time was buried.

Three days later, I received a telephone-call from the town clerk, informing me that some of the Swedish people felt that Johnson had been killed by the blow rather than by his own indulgence. I accordingly made an appointment to meet their people to get, if possible, a more accurate history; and on Friday I again visited North Easton, and at the house of the chairman of

[1] Read before the Society, February 5, 1896.

the selectmen had an interview with three Swedes, who told me that the board mentioned was a picket taken from the fence near the saloon, and that there were witnesses who saw some one strike Johnson on the head with this picket. This gave a very different aspect to the case, and I at once requested the chairman of the selectmen to sign the paper giving me authority to make an autopsy. It was agreed that the body be exhumed, and that I should make the examination on the following Monday morning, thereby giving opportunity for the Swedes to engage one or more physicians of their nationality to be present to witness the autopsy.

On Monday, February 18th, at 10.30 A. M., the autopsy was made with proper legal witnesses and in the presence of several physicians who had become interested in the case, and among the number, Dr. Richard Hogner, of Boston.

The body was generally discolored. Again a rigid search was made for any mark of violence, but with negative result. The spinal cord and the organs of the abdomen and of the thorax were examined, but no cause of death was found. In dissecting back the scalp, a little extravasated blood was found in the cellular tissue just above the left ear. This blood did not stain the true skin, as was shown by dividing the scalp over the extravasation. Under the left temporal fascia and between the fibres of the muscle, there was a considerable collection of blood. The outer surface of the skull showed no mark of injury. The calvarium was carefully removed and a large clot of blood could be seen lying within the dura mater, but there was no blood between the skull and the dura mater. On removing the dura, a large, thin clot was found covering a considerable part of the left side of the left cerebrum, measuring four inches in length by two to three in width, the thickest part about one-quarter of an inch in thickness. The thickest part was over the anterior portion of the middle lobe just back of the fissure of Sylvius, and at this spot there was a dark stain of the brain tissue one and one-half inches in diameter, but no laceration of the brain substance. The ruptured vessel could not be differentiated. There was no blood extravasated in the brain substance and none in the ventricles. The blood-vessels appeared to be normal, as did also the cerebral substance. The whole skull was carefully examined, but no fracture or fissure or indentation or abnormal irregularity could be found. A new report was made giving the cause of death "pressure of a blood-clot within the head, caused by a ruptured vessel and probably the result of a blow," and the case was reported for inquest.

At the time of my second visit, Mr. George E. Seaver, the State detective, was notified, and he took charge of the case, and when I gave him the result of the autopsy, he at once arrested Martin J. Conroy and John F. Moynehan upon a charge of assault with a dangerous weapon, and they were kept in jail till after the inquest, which was held in Taunton February 21st, before W. H. Fox, Esq. As a result of the inquest, the justice directed that the process for the apprehension of Conroy and Moynehan be issued, and February 28th they were both held and bound over to the grand jury on a charge

of manslaughter. In due time, the grand jury found a bill against them, and the trial occurred in Taunton, November 26, 1895.

At the trial, the facts were established much as in the foregoing history; but the testimony was not very incisive, which may possibly have been due to the necessity of interpretation, or possibly to other causes, such as indistinctness of recollection because of the convivialities of the Sunday in question, or from timidity and class prejudice. The important evidence was that of the medical witnesses, the contention of the defence being that the clot of blood, and hence the death, was due to inherent causes, such as excitement, whether physical or alcoholic or both.

The medical examiner gave the facts of the autopsy, and in answer to questions by the district attorney tried to establish the following propositions:

The cause of death was the pressure of the intra-cranial clot, which probably formed very gradually, since no laceration of a considerable vessel could be found; the same gradual bleeding enabled Johnson to walk home with his companions without showing symptoms of severe injury; increasing pressure may have caused nausea and determined the retreat to the out-house where the pressure became sufficient to produce coma.

An abrasion of the surface, or a laceration, even, may have been prevented by the hat that he is said to have worn and by the form of the striking body.

If life had been prolonged for a few days, doubtless the clot of blood in the cellular tissue would have diffused and made itself evident in a discoloration of the skin more or less extensive. The three centres of extravasation, each independent of the other and all in one plane, establish great probability of a common origin, namely, a blow.

The clots within the skull resulting from blows upon the head are generally situated upon the surface of the brain, sometimes within the membranes, but perhaps more generally between the dura mater and the skull. Whereas clots due to internal causes are more commonly found within the substance of the brain or in the ventricles of the brain, and generally there may be found in the circulatory system, brain substance, or elsewhere, evidence of a weakened condition to account for such hemorrhage. Cerebral hemorrhage from disease is rare in persons under middle age.

By cross-examination, in answer to questions by the defence, the following points were brought out:

Coma may be one stage of death by poisoning with alcohol. The symptoms due to the clot in the head might be the same, whether the clot were due to violence or to internal disease. The same results to the head might have followed a fall as well as a blow, provided the head struck some hard substance. The examiner was asked if the three clots in one plane may not have been a coincidence, instead of the result of one common cause; to this the reply of "Yes" was given with the suggestion that "many coincidences establish great probabilities." He was then asked to give the exact position and relations of the meningeal artery (which had not been mentioned before) and to describe fully to the jury the dura mater. This minute anatomical

examination went as far as demanding to know what lay between the meningeal artery and the dura mater; and the answer given was, cellular tissue.

It was agreed that alcoholic stimulation and physical excitement might increase tension and help to cause rupture of a weakened vessel.

The defence called a gentleman who "qualified" as a professor of surgery in a medical school in Boston, and joint owner and proprietor of a private surgical hospital in the same city. He appeared with a human skull wherewith he demonstrated the grooves for the meningeal artery. In his opinion, since the clot was not external to the dura the extravasation was not the result of a blow, but due to causes from within, such as excitement, whether psychical or alcoholic. The clots outside the skull seemed to have no great importance, and they were supposed to be coincidences.

At the close of the testimony the judge, on motion of the counsel, ordered a verdict of not guilty as to Conroy, since the evidence did not sufficiently implicate him.

The evidence was reviewed, and the case of Moynehan was given to the jury who returned in thirty minutes with a verdict of "guilty."

Moynehan was immediately sentenced to nine months' imprisonment in the House of Correction.

DISCUSSION.

DR. HOUGH: I should like to ask how to exclude in this case meningitis interna hemorrhagica.

DR. PRESBREY: I don't know, sir, how it is possible exactly to exclude it. It seemed to me that all the evidence was rather conclusive that it was not from any disease whatever, and there was no indication to the examiner of any disease of the tissues within the head.

DR. HURD: I have lately in my own practice as medical examiner seen cases of death by hemorrhage inside of the cranium. One was the result of a blow over the left ear; in another, a stone was thrown at a party from some little distance; in a third, death was the result of a blow by a billiard cue. In all three of the cases there was external extravasation of blood, in two of them considerable ecchymosis visible on observation. In one there was no external extravasation, but quite a large clot between the inside of the cranium and the dura mater and also a minor clot between the dura mater and the pia mater ploughing into the substance of the cerebellum for some little distance. In none of these cases was there any fracture of the skull. I rose principally for information and to make this point. In two of these cases I was refused an autopsy by the mayor of the city, on the ground that the cause of death was obvious enough. Everybody knew that the stone in one case killed the man and in the other the blow from the billiard cue, and it was not important to know how death was produced. In the other case, in Amesbury, I obtained authority from the selectmen. I was obliged in both cases to consult the district attorney in the matter. In both instances he was very emphatic in the expression of the opinion that in all such cases an

autopsy was desirable and necessary. Both the mayor and the judge of the police court refused to authorize the autopsy, the mayor feeling it was unnecessary and a needless expense to the county. In both instances the district attorney gave his opinion that an autopsy was desirable and necessary, and that he would not be willing to excuse a medical examiner from making an autopsy. I made the autopsy in each case. In two of the cases death was caused by compression from hemorrhage.

DR. HOUGH: I should like to mention a somewhat similar case. A man supposed to be in fair health was struck on the back of the head a little to the right of the median line by what was practically a club in the hands of a woman. Immediately after the injury, he walked something less than a quarter of a mile to the police station, and entered complaint against his assailant who was arrested. After remaining about the police station a little while, he started to walk home; an officer was sent home with him. On the way, he began to be unsteady, had difficulty in walking, and toward the end he had great difficulty so that the officer had almost to carry him upstairs and help him to bed. I was called in the afternoon by the chief-of-police to see the man, to see if I could get an ante-mortem statement. He was comatose and hemiplegic, and I advised that he be taken to the hospital for operation. In the evening we operated and found a large blood-clot inside the skull. It was between the bone and the dura, perhaps three inches in diameter, irregularly circular and about one-inch thick. The blood-clot was removed and the source of the hemorrhage was found to be a laceration in the longitudinal sinus. A tampon of iodoform gauze was put in and the man improved somewhat. The mental condition, however, never cleared up. He was at no time able to carry on any connected conversation whatever. He died on the ninth day of January. The assault took place on the 28th of November. Three hours after death, I performed an autopsy and found the conditions about the operation wound normal and everything doing as well as might be expected. There was a widely diffused meningitis over the whole of the convexity on both sides, over the upper surface of the cerebellum and to some extent at the base of the brain. There was a general, translucent, nearly opaque condition of the pia, but without the formation of any pus. The immediate cause of death was found to be in the right lung. It was a septic inflammation, a multitude of minute pus-foci being scattered through the lower lobe and about one-half of the upper lobe of that lung. The lung gave to the hand such an impression as you get when taking hold of the lung of a person who has been drowned, and the sero-pus exuded as the water exudes from the lung of one who has been drowned.

The case illustrates the fact that a considerable interval may elapse after assault before the serious symptoms come on, and illustrates, too, the difficulty that may arise in medico-legal proceedings as to the connection between the assault and the death.

DR. DOLAN: I had a man found dead, killed by a train, lying one side of the track on the bank; there was no mark on him, the only sign of injury

being hemorrhage from the nose. I could find nothing of an abnormal nature about the body, and at the undertaker's I went over the body thoroughly again and could not find a scratch or ecchymosis or anything. At an autopsy later, I found a complete circular fracture of the entire calvarium, extending round and round the skull, going through both tables and the brain full of blood.

DR. HARTWELL: In relation to a point not germain to the paper, but still having perhaps something in line, that is, death without marks of external violence. I recently attended a case of suicide in which a pistol was found near the body and no external marks of violence were present, nothing but a little blood running from one nostril. The body was frozen stiff; and when it thawed out, a day or two afterwards, a circular hole was seen through the hard palate where the pistol ball, calibre .32, had entered. The man had a very heavy mustache which was not burned; there was no powder-mark on the lip or face. He was a man in good circumstances, and evidently understood how to kill himself without a mark. He put the revolver in the mouth and fired. The ball evidently entered the basilar process of the sphenoid bone. Death must have been instantaneous.

A word on another part of the paper, the length of time before death after a serious injury. Ten years ago a man received a heavy blow with a flat-iron over the head, which made a three-cornered dent through the tables of the skull. He worked three weeks. The local physician sewed up the external wound. Nothing particular had taken place until I was called. He was then comatose. He partially regained consciousness, and died three days later from meningitis. There was very great injury of the brain at the site of the blow, but he performed his usual duties six days.

DR. PINKHAM: In relation to the matter of obtaining permission to make autopsies. I recall one case of death by cutting the throat in which the cause of death was perfectly obvious, but still the district attorney insisted that I make a careful autopsy and examine the whole body, and I think that is generally true of district attorneys, but it is different with the mayors and especially with the selectmen of towns. It seems to me an argument might be made here in favor of some change in the law by which the medical examiner should be put upon salary in all these smaller districts, then we should be in the same position as the medical examiners in Suffolk County, then we should make an autopsy whenever we think necessary or in any obscure death. I think some movement has been made in reference to a change in the law. I think it would be a very beneficial change.

DR. HOUGH: I know that has been suggested. I suggested it myself on at least two occasions, but the feeling has been one of hesitancy on the part of this Society to attempt to change the law in any way, through fear that if we make any suggestion looking to revision of the law it may be made worse than it now is.

DR. PAINE: In reference to injuries without external signs. In 1878, one Sunday night the police called me to see a man whom they had pulled out of

a pond-hole one-fourth of a mile away from where I found him. They found the man hallooing and got him out of the water. They took him, by my direction, to the lock-up. He was bleeding on the left side of the head. He walked down to the lock-up. On examination I found a compound comminuted fracture of the skull. The man could talk all right, walked all right, but could not give an idea of how it happened. We made arrangements to take him to the hospital. When I got to the station he was walking around the platform. I made him keep still. All the time he was conscious, but could not tell how this occurred. He remembered that he was in a certain saloon and did not remember of having any row. When I took him to the hospital they asked what I had and I told them. The house-officer looked as though it was a big story, and they let him walk to the ward. When the visiting surgeon examined the man, he put him on the stretcher and would not let him walk. They operated, and removed fifteen pieces of the skull. It was a very thin skull. The man lived seventeen days with hernia of the brain. It shows what a man can do with severe injury of the skull.

DR. ADAMS: In regard to cases of death by violence without sign of external injury, I recall a case. An old lady, over seventy years of age, was walking beside a railroad track. A train came up behind her and struck her a violent blow. She was thrown down and died in about two hours. I made the autopsy and found no signs of external injury whatever, nothing I could call a bruise or severe injury of any sort, skin not broken, ribs not broken. I found by autopsy that she died from rupture of the liver. The liver was ruptured and the cavity of the abdomen was full of blood. I made the autopsy on my own responsibility. It was a post-mortem examination, not a medico-legal autopsy. The contention of the paper I read here a year ago or more was to the effect that it was desirable we should have authority to make post-mortem examination in all doubtful cases. I had another case, somewhat similar to the one I have spoken of, where there was fracture of the kidney. In that case, I believe I called for a medico-legal autopsy. The man was doing work for the town. There were no signs of external injury. The kidney was ruptured by the falling of earth. The question has been raised as to how long a man might live after a fatal wound of the brain. A case occurred when I was in the army. A man was shot directly through the temples. The ball passed right through and he lived three weeks, and at the end of three weeks was walking about the wards carrying water to the other patients and talking a little, apparently not seriously hurt. He was taken suddenly with violent pain in the head, became delirious and died in twenty-four hours, and the post-mortem showed he died of disease of the brain, a piece of cap being carried in and lodging in the brain substance and finally producing abscess.

DR. DOLAN: I saw a case, a little child shot just above the forehead, and the child lived a week and played around and died of abscess of the brain. I went before the grand jury, and said it was perfectly possible for a child to live with a bullet in the brain. The other physicians scoffed at the idea, and

the very next week there came out a report in the *University Medical Magazine*, of a sailor who died in a hospital, and they traced the history and found that a year before, he had been shot in a street brawl, was laid off a few days and from that time until he came to the hospital, a few weeks previously, he had been working before the mast, and died of abscess of the brain after a year.

DR. HOUGH: Dr. John C. Gray, formerly a great expert in mental diseases in New York State, told me he had seen a great many cases of people who had received bullets in their brains and had not died very soon, but that his experience was that ultimately some serious brain trouble would develop in such cases which might lead either to permanent mental deterioration or very likely to death.

DR. PRESBREY: I recall some experiences before the day of the medical examiner. I remember two cases that happened to me somewhat in the same line, the first an injury without immediate death. I was called as physician to attend this man who in a squabble had been struck with a knife which entered the side of the head in front of one ear. We had no hospital in Taunton, and I advised his removal to the Massachusetts General Hospital. He was taken to the hospital, where he was kept two or three weeks, and no operation was done. This was about twenty years ago when brain surgery was looked at timidly. The man was supposed to be doing well, and he came home. On coming home he was suddenly attacked with violent pain in the head, and I was called again, and he lived but a day or two. The death was over three weeks from the time of the injury. I made an autopsy, and that man died of abscess of the brain.

Another case that occurred to me, when I was employed by the coroner in former days, was that of a man who went out of a drinking saloon; and as he came out upon the sidewalk, he met a friend who had been lying in wait for him. This friend struck him one blow under the ear. He collapsed upon the sidewalk, was picked up and taken to the police station; and when they got the man to the station, he was dead. I made the autopsy. There was no mark upon the man, but the autopsy was very satisfactory in that it showed a large clot of blood — I cannot recall now just its relation to the dura mater, but I presume it was within, because the pressure was mainly at the medulla oblongata and extending into the vertebral canal. The man who struck him went to the State's prison for fifteen years.

DR. PADDOCK: This is an interesting paper of Dr. Presbrey, and the discussion following has reminded me of two instances that came under my observation; one in regard to the amount of injury which can be done to the brain and still allow the person to live in comparative health is illustrated in a case that occurred about three years ago. A man in Berkshire had presented to him a bird dog. This man was strong and vigorous, took the dog into the yard with a chain on him, and took his old-fashioned gun to see if the dog was gun shy. Looking at the dog held by the chain, he raised his gun and fired. The gun burst, and the breachpin was blown out and struck the man

in the forehead making a hole larger than the finger. This man lived about four miles from a physician and twelve miles from my own place of residence. This was in the afternoon. Late that night I received a telephone-message to come and see this man. As it was very dark and rainy and he was not unconscious, I went in the morning. I found the man in bed, perfectly conscious, with this large opening in the skull just above the root of the nose — a great many fragments of bone loose. I took out a handful of pieces of bone of the internal and external table. A large amount of brain substance had oozed out, and I told the doctor there was nothing to do except to clear out this opening and let him live as long as he would. The breachpin of the gun was lost, and there was every supposition that it was in the cavity of the skull. We let the man out of ether, and upon further questioning we found he was perfectly deaf in his right ear. The wound granulated and healed kindly, and the man got perfectly well with the exception of partial loss of the hearing of the right ear; and about a year afterwards he sold his place and moved to Illinois. A few months ago I received a letter from the doctor to whom he had just paid his bill, that he was in perfect health, and had no headache. There is reason to think that the breachpin, which was one-half inch in diameter, is in the man's head now.

STAB-WOUND OF THE PULMONARY ARTERY.

A Medico-Legal Report.[1]

BY O. J. BROWN, M.D., OF NORTH ADAMS,
Medical Examiner.

On May 28, 1890, at 7.40 o'clock, A. M., the selectmen of Stamford, Vt., summoned me to an old farmhouse in a remote section of the town to examine the dead body of a woman, and ascertain, if possible, the cause of her death. Two esteemed *confrères*, Drs. Bushnell and Nichols, were present.

The body was lying upon a bed in a dark room, nine by nine feet, opening into the kitchen. A prolonged drunken carnival had been going on in the house for three days. The deceased was the only female participant. Four men were in custody, charged with drunkenness and a possibility of murder. The whole house was in a condition of filthiness and disorder. Windows were broken out, rooms were strewn with fragments of broken glass and earthenware. The kitchen table was covered with broken bread, cheese, and particles of glass, all so thoroughly mixed as to appear as one article of fare. A barrel of sour cider had been brought from the cellar to the kitchen for greater convenience, and placed on tap. The room where the body was lying had served as a common urinal. There was fecal matter upon the floor. Under the front edge of the bed near its foot was a spot of blood about four inches in diameter.

The body was that of a rather attractive looking woman, middle-aged and of medium weight. It was lying on the back, a little inclined to the right side; the head a little lower than the hips. The right forearm was at a right angle with the arm, the hand resting over the stomach, with fingers extended. The left arm, nearly extended, lay by the side, with the hand in front of the left hip. The legs were drawn up at a right angle, the left one lying over the right. The hair was very long and badly snarled. The eyes were sodden and the teeth badly decayed. The body was clothed in a black jersey sack, plaid gingham dress, light undershirt, Canton-flannel skirt and cotton chemise. On the feet were rubber boots and two pairs of cotton hose. The clothing was old and soiled; the skirts and chemise were a little spotted with blood. Under the body was a feather bed, a mattress, an old pillow, a quilt, and a sheet.

Upon bringing the body into a better lighted room and removing the clothing, I found all that portion of the apparel that was in contact with the chest saturated with blood. In the left side, two inches from the median line of the body and one and one-half inches below the clavicle, was a wound. It

[1] Read before the Society, February 5, 1896.

was a smooth, nearly transverse cut, one-half inch long and directly over the third rib. A cut corresponding with this was found through all the clothing covering the chest. A closer inspection of the dress-waist revealed still more blood-stain. An ordinary pocket-case probe easily entered the wound one and one-half inches. Its course (the body lying on a horizontal plane) was downward, backward, and to the right. Upon opening the chest, blood flowed freely from the left pleural cavity. The course of the wound was now readily seen, and could be followed through the chest wall just below the third rib. It had penetrated near the anterior margin, through the upper lobe of the left lung; it had also pierced the pericardium, from which blood oozed, and which was filled with liquid blood and soft clots. Now that the pericardium was laid freely open, the wound was further seen, extending into and completely through the pulmonary artery into the muscular wall of the heart. The heart, normal in appearance, was practically empty. I found two quarts of blood, mostly liquid, in the left pleural cavity. The lungs, aside from the wound, were normal.

The abdominal organs were in a healthy condition. Animal heat was still noticeable in these organs. The stomach was empty. The organs of the pelvis were in a fair condition; the uterus, however, showed signs of disease in the cervical portion. There was a filthy condition of the vagina and a markedly flabby appearance of the external genitals.

The contents of the skull were normal in appearance.

The cause of death was defined as "a punctured wound in the left side of the chest, penetrating the pulmonary artery and the heart."

At this time, none excepting the perpetrator of the deed had mistrusted the cause of death; and not until the result of the autopsy was made known, did it dawn upon the other prisoners but that each, on account of criminal relations with the woman, might be held accountable for her death. No weapon or instrument could be found about the premises that was likely to have been used in making this wound. The four prisoners were then searched and upon the person of one of them was found an ordinary jackknife that in length and size of the blade corresponded to the size and depth of the wound. This man was upon trial found guilty of murder, and received a life sentence.

It appeared in evidence that, at the time of the stabbing, the house was comparatively quiet, the inmates having relapsed into a state of repose; this was quickly terminated, however, by audible groans — "Oh! Oh! Oh!" — three in number, uttered by the dying woman. The prisoner having the knife had been seen returning to the house from a spring ten rods away, at the time, or very soon after, the dying groans were heard. There was no blood-stain found upon the knife.

Could death have taken place so slowly as to allow this man time to visit the spring, wash away all blood-stain and return by the time the other prisoners (the only inmates of the house) had been fairly awakened by the dying groans? The defence endeavored to prove this claim an impossibility. It was declared that death must have occurred almost instantly, and that the

wound was inflicted by another while this prisoner was away from the house after water.

In the long, tedious trial, and after one year in a second trial of this case, there arose many interesting medico-legal interrogations; for example, When was the approximate time of death? How long did the woman live after receiving the mortal wound? And questions relating to the circulation were asked; as, What is the quantity of blood in the body? How long a time is required for it to traverse the whole course of the circulation? What are the uses of the blood? etc. Both Commonwealth and defence had the usual array of medical experts; but happily in this trial their testimony was candid and unbiased. Their replies substantially agreed, commanding the close attention and profound respect of court and jury. I will quote in substance some of the more interesting answers, and make references to authors who have treated the subject of the circulation with elaboration. The time (approximately) of the murder was determined by the temperature of the body and rigor mortis at time of autopsy. It was practically agreed that death had occurred twenty-four hours before the time of autopsy.

To determine the length of time the woman lived after the infliction of the wound was more difficult. Most of the medical witnesses testified that death took place in from twenty to thirty seconds. I was forced to believe it slower, and stated that while it probably occurred within one minute after the infliction of the wound, two or even three minutes might have elapsed before the complete cessation of the heart's action; that this organ continued its work as long as there was any blood-pressure is proved by its being found empty at the autopsy. It is my impression that the right side of the heart would rarely be found empty in fatalities of this nature. Taylor teaches,[2] that "A quantity of blood escaping from a vessel, although insufficient to cause death by affecting the heart and circulation may readily destroy life by disturbing the functions of the organ or part into which it is effused. . . . A few ounces effused in the cavity of the membrane enclosing the heart (pericardium), will entirely arrest the action of this organ."

Our answers to inquiries pertaining to quantity and velocity of the blood were practically alike. The average quantity of blood in the healthy adult was estimated by weight as about one-thirteenth of the weight of the body. There is considerable difference in this estimate among authors, who give the quantity of blood, by weight, compared with the weight of the body, as follows:

Kirk	One-twelfth to one-fourteenth.
Foster	One-thirteenth.
Mendelsohn	One-twelfth to one-thirteenth.
Béclard	One-twelfth to one-thirteenth.
Volkman*	One-twelfth.
Welcker*	One-thirteenth.
Vierordt*	One-thirteenth.
Bischoff*	One-thirteenth.
Valentin*	A little less than one-fifth.

* Cited by Béclard.

[2] Taylor's Manual of Medical Jurisprudence, chap. xxviii.

Taylor	One-fifth.
Dalton (minimum)	One-eighth.
Flint	One-tenth.
Allen Moulins †	One-twentieth.
Hirst †	A little more than one-twentieth.
Hoffman †	One-fifth.

† Cited by Flint.

The time required for all the blood to pass through the heart, or make one round of the circulatory system, was given as about thirty seconds. Upon this subject the same authors are more harmonious. Kirk's [3] estimate of the time required for all the blood to pass through the heart is from 20 to 50 seconds, Foster's [4] less than 30, Mendelsohn's [5] 23, Béclard's [6] 37½, Dalton's [7] 18 to 45, and Flint's [8] 23.

While physiological questions like these may not often occur in court, they are practical, and their solution affords aid in solving the pathological problems that so frequently confront us. It is the current opinion of the laity and possibly some of the profession that the quantity of blood in the body is subject to great variation. The plethoric or florid individual, it is thought, or one who has just regaled at the dinner-party, possesses considerable more blood than the person of pale countenance, the hungry and poorly fed. That the male has considerable more in proportion to the weight of the body than the female, and that infants possess much less in proportion than adults, is also believed. While under certain conditions or to a slight degree these theories may be true, they are, generally speaking, fallacies. Authors now teach that the actual quantity of blood in the body is practically the same under nearly all circumstances, and their claim is well substantiated by experimentation.

With further reference to the case of the woman we have been considering, it seems that there must have been an abnormal tardiness in the circulation of the blood to permit her to survive a stab, penetrating the pulmonary artery and heart, so long that the convicted murderer could go to a spring 165 feet away and return, after cleaning his bloody weapon, and be noticed by his comrades who were aroused by the dying groans of his victim, while he was retracing his steps to lie down by their side and in slumber seek forgetfulness of his crime.

DISCUSSION.

DR. HOUGH: It is a quite well-known fact to those who have investigated this subject that after pretty considerable wounds, even of the heart itself, a person may live for a surprising length of time. In a number of cases that have come to trial for homicide it has been proved that a person after a stab-wound or bullet-wound may without doubt live and even walk about for some months. I think that is perhaps important in this connection as bearing upon

[3] Kirk's Handbook of Physiology.
[4] Foster's Text-book of Physiology.
[5] Wood's Handbook of Medical Sciences.
[6] Traité Élémentaire de Physiologie Humaine, par J. Béclard.
[7] A Treatise on Human Physiology, by John C. Dalton.
[8] Text-book of Human Physiology, by Austin Flint.

how long this woman may have lived after this injury was received. As to hemorrhage into the pericardium as cause of death, I recently saw an interesting case. A man was taken suddenly with severe precordial pain, growing rapidly worse, the pulse becoming very feeble. He died twenty-four hours from the first symptom. The autopsy showed the pericardium distended with at least a pint of blood and blood-clots which came from the ruptured atheromatous aorta within the pericardium.

THE CROSBY HOMICIDE.[1]

BY JOHN F. CROSTON, M.D., OF HAVERHILL,

Medical Examiner.

On the 17th of August, 1894, there lived in Merrimac, Essex County, Jacob D. Crosby and his family. They lived on the direct road between Haverhill and Merrimac, in that part of the town that is known as Saunders' Hill. That part of Merrimac in which the Crosby house was situated is in the farming district and is somewhat away from the village, and is about five miles distant from Haverhill. The next house in the direction of Haverhill, on the same main road, was a house occupied by a brother of Jacob D. Crosby.

The Crosby family retired upon the night of this occurrence at the usual hour. Some time between eleven and twelve o'clock of the same night, the inmates were aroused by sounds that indicated that some one was endeavoring to break into the house. An alarm was given, and the household awakened. Those who were seeking entrance first sought it at the rear of the house; subsequently they went to the front of the house, and were seen by one or more of the family but not identified. Mr. Jacob Crosby went to the front door, lifted the curtain and saw some one pointing a revolver at him; he dropped the curtain and retreated hastily to the rear of the house toward the barn, where he kept a double-barrelled shot-gun. In the mean time a shot had been fired through the glass panel of the front door; the bullet passed through the wood-work of a staircase and was found some time afterwards, showing evidence of rats' teeth upon it. This bullet was of .32 calibre, and, as will afterwards be proven, was not the size fired from the revolver that did the fatal shooting. Mr. Crosby, upon reaching the barn, found that his gun had been taken from its accustomed place. The gun was afterwards found hidden in a grape vine behind the barn, and it was afterwards proven that it had not been used at any time during the shooting. The eldest son went with his mother to the house of his uncle above mentioned, and notified him that there were burglars in their house. The uncle dressed himself and accompanied by his nephew, started in the direction of his brother's house, coming up a pathway which leads by the barn. As they turned a corner in the path, they saw three men approaching from the direction of the house around a corner of the shed. On the witness-stand, the boy said that the burglars had in their hands drawn revolvers, and as they met, the first salutation that came from the burglars, was "Hands up" or "Throw up your hands!" Crosby said nothing, still advancing toward the men, and grappled with one of them, but before they grappled, the same one who had

[1] Read before the Society, February 5, 1896.

accosted Crosby by the challenge "Throw up your hands!" fired his revolver, not hitting him, however.

The weight of evidence bore out the fact that the man he grappled with was a man named Johnson, one of the burglars, who had in his possession the .32 calibre revolver, and which, it was proven, was not the one that inflicted the fatal wound. While they were still struggling, one of the other two burglars came up, either with, or without saying something, and fired deliberately at Crosby's side. The wounded man made an outcry, but still clung to the man with whom he was in conflict, and then the same one who fired the shot, took his revolver and beat Crosby over the head, until he fell insensible. The wounds on the head, which will be described later, indicated that they were inflicted by a blunt instrument, and this was afterwards shown to be the sight-piece on the revolver, owned and proven to have been in the possession of Hunt, the undoubted murderer of Crosby. Crosby never regained consciousness and died within fifteen minutes of the time of the shooting.

The first knowledge I had of the murder was at seven o'clock the next morning, showing an unpardonable neglect on the part of the police or other responsible parties, in not notifying the medical examiner. I proceeded immediately to the place of the murder, and met the body on the road, being carried from the house of Jacob Crosby to that of the deceased, where I made the view, and in the afternoon of the same day made the autopsy.

The clothing at this time had been removed from the body, and the body was prepared for burial. I made a search for the clothing, and found it scattered about in the house of Jacob Crosby and that of the deceased. An examination of the coat showed two perforations in the lower portion of the left sleeve, about six inches from the body; a perforation in the left side of the body of the coat, but no rent in the right side; a perforation through the vest and shirt, and in the waistband of the trousers, on the right side. I examined these perforations very carefully for powder-stains, and signs of burning, and found neither present. The clothing was afterwards examined by experts, and their opinions will be given later.

An autopsy was made on the afternoon of August 18th, assisted by Drs. Sweetsir, Bolton and Durant, sixteen hours after death. The weight of the body was about 150 pounds; its height was 5½ feet. Rigor mortis was present. There were two incised wounds on the forehead, one over the upper and outer margin of the right orbit, a quarter of an inch above the superciliary ridge, an inch and an eighth long by one-fourth of an inch wide; the other wound on the forehead was an inch and three-quarters vertically above the inner extremity of the superciliary ridge, and was half an inch long by one-fourth of an inch wide. There was a contused wound over the upper middle portion of the occiput, three-eighths of an inch long by one-fourth of an inch wide, which penetrated the scalp; there were also several minor contusions on the right side of the face.

An examination of the chest showed a wound half an inch by a quarter

of an inch in the eighth intercostal space, on the left side, one inch and a half anterior to the axillary line and three and a half inches below the left nipple.

There was a wound in the right flank, half an inch by a quarter of an inch, in the mid-axillary line an inch and a half above the crest of the ilium.

The pericardial sac contained one ounce of bloody fluid, but the heart was normal. No fluid was found in the pleural cavities and there were no adhesions. The right lung was normal; the left lung the same except for a slight ecchymosis in the most dependent portion of the lower lobe. On dissection a perforation was found in the left anterior segment of the diaphragm, admitting the tip of the index finger.

The abdominal cavity contained five pints of blood. The examination of the stomach showed two perforations in its anterior wall — a wound of entrance and one of exit, admitting the tips of two fingers; otherwise the stomach was normal. The path of the bullet could then be traced by a bloody line to the under surface of the right lobe of the liver, which was torn and lacerated in several places. No other change was noted. The intestines were not perforated, and were normal in appearance except for slight post-mortem discolorations.

All the other organs were found to be normal.

The course of the wound was now followed through the muscles, to the point of exit, one inch and a half above the crest of the ilium.

Within forty-eight hours of the time of the murder, three men had been arrested, Hunt, Johnson and Little, the latter of whom had been employed on the Crosby farm during the early spring and summer, and was particularly familiar with the hiding-place of the gun, before mentioned; these facts gave the first clue to the discovery of the murderers. Within the next few days Little became a witness for the Commonwealth.

Soon after the murder, at the very place, or within a foot or two of the spot where Crosby fell, was found what was first supposed to be a bullet; its weight and size were such as to indicate to the non-professional observer that it might have been fired out of the revolver proved to have been in the possession of Hunt before the murder. It was sent to Professor Wood of the Harvard Medical School, and the following in substance was his report: The supposed bullet was roughened, filled with holes, and these holes were filled with gravelly dirt. In the small end, the dirt had a reddish color, and on removing this dirt, a small piece of iron or steel was found at the bottom of the cavity, and on testing the dirt for blood pigment, none could be found; the red color evidently was due to iron rust. A suspicious spot on the side was also tested for blood, with negative result; the dirt was then removed from the hole in the side, and it was noticed that the portion from the inner part, came out as though it were caked, more or less moist and flaky, and the tests for blood with that dirt, indicated the presence of blood pigment. A large number of red blood-corpuscles were found of the average measurement $\frac{1}{3250}$ of an inch, or thereabouts, being within the limit of average of human red

blood-corpuscles. The cavity in the other end was tested with negative results. The piece of lead or bullet was accurately weighed and found to be 222.45 grains; but, although this piece of lead had all the appearances of a bullet, there were some doubtful peculiarities about it, and it was presented for examination to two different experts, independently — Chas. H. R. Dimond and George E. Russell — and it was pronounced by them to be not a bullet that was ever fired from Hunt's revolver, or any other rifled weapon. The most natural inference, after the testimony had been submitted, was, that it was a piece of lead used as a curtain weight, having the appearance and shape of an old-fashioned bullet.

Three days after the murder and twenty-four hours after the arrest of Hunt, the pawnshops of Haverhill were diligently searched, when it was accidentally learned that Hunt's father had brought a revolver to the shop of a Mr. Jewell to be pawned. Mr. Jewell volunteered the information that the revolver had been purchased by the younger Hunt about one year previous. This revolver was immediately taken possession of by the police and sent to Professor Wood for examination. It had previously been cleaned, apparently with great care. Dr. Wood reported that he looked the revolver over very carefully and saw nothing to indicate the presence of blood, until he examined it with a magnifying glass, when he saw a suspicious spot on the end of the rivet which held the sight-piece in place, on the right front side of the sight. On examining the sight more carefully, it was noticed that it was quite loose, so that the point of a knife blade could pass down the sight on either side, to a depth of one-sixth or one-eighth of an inch, indicating that the sight was not held tightly in its socket. He pressed on the rivet and loosened it, and removed the sight from its position, and saw underneath, on both the right and left sides of the sight, quite a number of red stains, and testing all of these, the stains on the end of the rivet, the stains on the portion of the sight which was visible on inspection before removal, and the stains on both the right and the left side of the site, on the deeper portion, where it could not be seen without being removed, he found that they all contained blood, blood mixed with more or less iron rust, blood pigment; on examination of the blood-corpuscles with a microscope, he found red blood-corpuscles of the average measurement of human red blood-corpuscles.

The finding of blood-stains on the sight of the revolver, proved conclusively that this was the weapon used to inflict the wounds described in the autopsy, and assumed to have been made by a blunt instrument on the forehead of Crosby after the shooting. The clothing was also submitted to Dr. Wood, who found no evidence of scorching or burning or appearance of powder.

Dr. Frank W. Draper was called by the government as an expert on the question of the effects of pistol-shots upon the clothing, with reference to the distance from which the shots are fired. Mr. Crosby's coat was submitted to Dr. Draper for examination, and the results were negative, he finding no evidence of powder staining or burning. Dr. Draper procured cloth as near the texture and weight of Mr. Crosby's coat as could be found. Ten shots

were fired, one being rejected on account of an error in distance; the cartridges were of .44 calibre, of Smith and Winchester make, centre fire, and the result of the experiments was presented to the jury in the shape of pieces of cloth, showing the effects of the shots fired at different distances; the distances were from four to twenty-four inches. At a distance of twenty-one inches, the effects were very indistinct, only a little singeing of the nap of the cloth above the bullet hole being left, and a few grains of powder lying loosely on the surface of the fabric.

The next shot was at a distance of twenty-four inches; the effect was scarcely to be seen on minute inspection, a little singeing of the nap of the cloth could be discerned above the entrance hole of the bullet, but it had to be examined with the greatest care to be discovered. Dr. Draper stated that in his opinion, and to the best of his judgment, the distance that Hunt stood from Crosby when he fired the fatal shot, was above eighteen inches and probably above twenty-two inches range.

Hunt and Johnson were tried at the February term of the Superior Criminal Court holden at Salem, February, 1895, Justices Bond and Braley presiding. District Attorney Moody conducted the case for the government ably, and Messrs. Brickett, Jones, Hurlburt and Bartlett for the defence. The jury returned a verdict of manslaughter, and the prisoners were sentenced to twenty years in State's Prison.

REPORT OF THE LEEMAN MURDER.[1]

BY A. ELLIOT PAINE, M.D., OF BROCKTON,
Medical Examiner.

On the evening of April 26, 1892, about 9.20 o'clock, I was called to the residence of Collin A. Leeman, who had been found assaulted on one of the principal streets in Brockton. I found him in a dazed condition, and bleeding freely from wounds on the head. There were two incised wounds; one on the back of the head (transverse), the other just to the left of the median line (longitudinal). Each wound was two and one-half inches in length. There was a severe bruise under the left ear; another, on left side of chin, with considerable swelling. Scratches were found on the back of both hands and wrists. He knew me and talked about his injuries, but was unable to remember how they occurred. I dressed the wounds and put him to bed, not considering the injuries serious. I learned from his wife that he was found by some young men about a quarter of a mile from his house, and they assisted him home; that he had been robbed, as his watch, and pocket-book, and a shot-bag, in which he carried his change, were missing. On my way home I met the police, and with them, looked over the ground. We found signs of a scuffle, and, down an embankment, marks on the ground where something had been dragged. We found the man's dinner-pail, knife and key.

Just after midnight I was called again to see Leeman, his wife having found, a short time before, that she could not wake him; he was in a comatose condition, with paralysis of the right side; he remained in the same condition until about noon, when he died.

In the afternoon I made an autopsy. I found the wounds as described. The one on the back of the head was simply a flesh wound; the one on the top of the head extended through to the skull. On removing the scalp, the whole left side of the skull was seen to be covered with a thin clot and a fracture of the skull without any depressions was found, about one and one-half inches long, corresponding with the wound of the scalp. On removing the calvarium, the fracture was found to extend through, rupturing one of the branches of the middle meningeal artery. A clot seven inches by five and one-half inches, and one and one-half inches thick was found external to the dura mater on the left side. The brain was somewhat engorged, and showed a few small clots in its substance. At the posterior lobe of the cerebrum, in the median fissure, was a clot about the size of a bean.

All the other organs were normal.

[1] Read before the Society, February 5, 1896.

Collin A. Leeman was a barber and a repairer of watches; he was about five feet, six inches in height, and was club-footed on the left side. On the night of the assault two ladies called at his shop with reference to repairing a clock; they had some conversation with him, and noticed a man in the chair, but could not identify him. The police were unable to get any trace of the party who committed the assault until the spring of 1895, when word was sent them that a woman could tell them something about the Leeman murder. After a severe questioning, they learned from the sister-in-law of a man named Albee that on the night of April 26, 1892, he came to her house about nine o'clock; in going into the kitchen a few minutes later she found him putting a pair of shoes and overalls into the stove; she noticed blood on them. His reason for destroying them was, he said, that he had been on a hen-raid and was afraid the police would find him. Afterward he told her he was at Leeman's shop that evening, and while there two ladies came in; and he gave her the same conversation as the ladies had stated they had. He also told her he came near being caught, as he met a man near the place of the assault with two dogs; this man watched him. The officers found a gentleman (a physician) who said he saw a man near the place of the assault, and described Albee. Albee was arrested in the spring of 1895, and an indictment was found by the grand jury. He was tried in October, 1895, for murder. The defence was an alibi.

A woman was brought from Rhode Island, where Albee had been living, who testified that he was trying to have her live with him, and said if she would not, he would kill her as he did the club-footed barber in Brockton. He said he did not intend to have killed him, that he had a hard tussle with him and he found after a few days he had only taken a part of the money, as he threw the shot-bag away (this bag was found near the place the day after the assault, and in it were two five-dollar bills). Part of a sword-fish's snout was found at the house in Brockton where Albee stopped; and in Rhode Island an old-fashioned wallet was found which Mrs. Leeman identified as her husband's. Parties testified they saw Albee when he went into his brother's house April 26, 1892; he was running.

The accused said he was not in Brockton that night, and had respectable witnesses who said he was working four miles away, although they could not say where he was that night. The Commonwealth was unfortunate in having some of its most important witnesses of an inferior kind, and the prisoner was acquitted.

APPENDIX.

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TRANSACTIONS

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TWO CASES OF MEDICO-LEGAL INTEREST.[1]

BY J. G. PINKHAM, M.D., OF LYNN,
Medical Examiner.

CASE I. Acute cerebral leptomeningitis following blows upon the head, with late development of serious symptoms and death thirteen days after the injury.

The history of this case is briefly as follows: C. M. a mechanic, aged twenty-two, came to this country from Denmark six years ago. After coming here he worked pretty steadily at his trade. For four years he was employed by the General Electric Company, of Lynn, leaving of his own accord in January, 1896, because he was given work, which, on account of a disabled left arm, he found it difficult to perform. During this time, his reputation for sobriety was good. He took beer occasionally, like many others of his people, but was never regarded as a drinking man. His home for two years preceding his death was with a married sister, one Mrs. S., a woman of intelligence and of excellent character.

On March 31st, being then, as usual, sober, M. went to West Newton to visit a married sister living there. The next forenoon, still sober, he went out to look for employment. On the evening of the same day he was in Boston, and in company with another man went into a Chinese laundry. While there a difficulty occurred, and he was struck on the head twice with a piece of soapstone by one of the Chinamen. Later, he was found in the street by a policeman. He was then bleeding from a wound in the head, and was thought to be very drunk. He was taken to a physician's office (this was about 10.30 P. M.), and his wounds were dressed. He was then put under arrest for an assault on the Chinaman, and then taken to jail. The next day, April 2d, he was tried, convicted and sentenced to one of the penal institutions of this city for thirty days.

Mrs. S., the sister, saw him in jail after the trial, on the same day. She says that his head was bound up, and that he complained of headache. She was not allowed an opportunity to converse with him freely, an officer being present who interrupted her whenever she attempted to ask him about the trouble with the Chinaman. He did tell her, however, that he was not at fault in the matter, the other man being the one who created the disturbance.

On April 3d he was sent to the reformatory and put to work. The phy-

[1] Read at the Annual Meeting, June 9, 1896.

sician there reports that on the next day, April 4th, he was seen at sick-call, and a small wound on the forehead, with one stitch in it, was dressed. Three days later the wound having completely healed, the stitch was removed.

On the 10th, having worked from his arrival up to that time, he complained of feeling "mean," and was admitted to the hospital for observation. On the night of the 10th he became delirious, his delirium resembling in every particular, it was said, that produced by alcohol. On the next day the delirium continued, and there was a marked rise in temperature. A consultation was held, and it was decided that the symptoms pointed to a complicating central pneumonia.

On the 13th he died; and the cause of death was returned as the delirium tremens and pneumonia.

The body was taken to Lynn for burial, and the sister, who thought that justice had gone astray in this case, laid the facts before the city marshal. She complained because the young man's friends were not allowed an opportunity to see him before his trial and to assist in his defence, and also, because they were not notified of his serious illness in season for them to visit him before his death. She could not believe he died of delirium tremens, as she knew he was not an intemperate man. It was her purpose, she said, to appeal to the Danish Consul, as her brother was a citizen of Denmark, and ask him to make an investigation. The city marshal referred the matter to me, with the statement that he thought an autopsy advisable. Thinking that there was good ground for this opinion, I acquiesced, and made an autopsy, with the assistance of Dr. H. W. Newhall, of Lynn, on April 17th, four days after death. Below is given the official report of the autopsy in a somewhat abbreviated form:

Body well nourished. Rigor mortis everywhere present. Post-mortem lividity in the usual situations. The abdomen is moderately distended, and there is a greenish discoloration of the whole surface, the same extending up on the left side to the nipple, and backwards to the axillary line, where it is merged in the cadaveric lividity of the back. There is also some greenish discoloration in the intercostal spaces on both sides in front of the thorax. A reddish-brown liquid of offensive odor escapes from the mouth when the body is moved. There is a stellate scar of recent formation, a little more than one-half an inch in extreme width on the forehead, just to the left of the median line, under the edge of the hair; on the right of the median line, near the eyebrow, is a patch of greenish-yellow discoloration of the skin about one inch in vertical diameter and of variable width. The scalp divided and turned back in the usual way shows on the under side a patch of ecchymosis about an inch and a quarter in length by one inch in breadth, beneath the site of the stellate scar before mentioned; also some ecchymosis beneath the site of the discoloration lower down on the right. Calvarium removed. Dura mater somewhat congested, and adherent to arachnoid along the margins of the longitudinal sinus and elsewhere over and in the neighborhood of the Pacchionian bodies. Pia mater everywhere highly congested, with effusion of serum be-

neath the arachnoid, and grayish-white patches (collection of sero-pus) here and there over the whole convex surface of the brain. Left lateral ventricle contains about three drachms of turbid and bloody serum. The right lateral and the third ventricle contain bloody serum. The substance of the brain appears healthy, except that the *puncta cruenta* are more noticeable than usual, showing some congestion.

The thorax opened, shows the right lung normal in every respect, the lower part being very dark from hypostatic congestion. The left lung is pretty generally adherent to the walls of the chest. Adhesions easily separated, but not recent. There is a small amount of bloody serum in the left pleural cavity. Left lung more congested than the right, but it floats in water as a whole and in sections and crepitates everywhere on pressure, and exudes a bloody froth from its cut surfaces. There are some hard masses as large as good-sized peas in the root of the lung near the bronchus; all other organs healthy. The lower end of the ileum was examined for evidence of typhoid fever, and none found.

Remarks. — It will be seen that the autopsy in this case excludes pneumonia as one of the causes of death. As the man can be shown to have been sober on the morning of the day on which he was assaulted, and for many days previous to that; as he was not an intemperate man, only occasionally taking a glass of beer, or something of the sort; as he showed no sign of alcoholic delirium for ten days after his arrest, it is safe to say that he did not have delirium tremens. And, furthermore, as he received two severe blows upon the head, it is not improbable that he was partially stunned, or dazed, by them, and that this condition added to the fact that his breath smelt of beer, might have given to the officer who arrested him and to the physician who dressed his wounds the impression that he was very much intoxicated. It may be stated here that one witness is ready to testify to the fact that shortly before the time of the assault, M. was not intoxicated.

It is not an uncommon occurrence for a concussion, so-called, of the brain, even of a moderate degree of severity, if neglected or improperly treated, to result in meningitis and in death, sometimes as late as two or three weeks after the injury.

Put now all these facts together — the assault on the 1st of April; the arrest, trial, confinement in jail for three days; the hard labor for seven days; an apparent absence of the proper treatment for a concussion of the brain; the final illness of three days' duration, the clinical history (meagre, as obtained, but significant) of general malaise, fever, delirium; the autopsy, excluding other causes of death, and showing a general cerebral leptomeningitis with purulent effusion — putting, I say, all these facts together, can we avoid the conclusion that the blows upon the head were the primary cause of death? If we reach this conclusion, what is now the legal status of the affair, in view of the fact that the matter of the assault has been adjudicated once, and the deceased condemned? There can be no doubt that the assault committed by M. upon the Chinaman was merely technical; the actual assault, the violence,

was inflicted upon the deceased himself by the man upon whose testimony alone with that of his associate in business the conviction was secured. Can the case be reopened and the Celestial tried for manslaughter now that M. is dead by his act? These points, it is without doubt the duty of the authorities of the law to settle. The inquest has not yet been held.

Case II. Diffuse hemorrhage of the pia mater occurring during sexual intercourse and causing sudden death.

Mr. H., thirty-eight years of age, married, a barber by trade, was found dead at 5.30 P. M., May 22d, in a room occupied by a woman of questionable character. On my arrival at 6.25 P. M., I found the body in bed underneath the outer covering, with no clothing on it except the two shirts ordinarily worn in the day-time. It was lying on its back near the middle of the bed, with face turned slightly to the left, and away from the wall of the room against which the bed was placed. The right leg was nearly straight and in line with the body. The left leg and thigh were semiflexed. The arms were lying by the sides. Face rather pale, eyes and mouth closed. There was no rigor mortis, and but a slight degree of post-mortem lividity. On the glans penis and exuding from the urethra on pressure was some fluid resembling semen in appearance. Right testicle enlarged. No marks of violence to be found upon the body.

As the woman in whose room the body was found gave an unsatisfactory account of the affair, she was taken to the police station and detained to await the result of an autopsy.

The body was removed to the morgue, and an autopsy made on the same day, at 8.40 P. M., in the presence of the city marshal and Dr. C. C. Sheldon, of Lynn. On section of the body, the liver was found to be enlarged and fatty in appearance. The spleen was somewhat swollen and hard. The lungs, heart, kidneys, pancreas, intestines and bladder were healthy. The gastric mucosa appeared somewhat thickened; it was red in streaks and patches, and covered with a layer of thick, dirty-looking mucus. The large veins and the cavities of the heart contained very dark blood, mostly fluid. On removing the calvarium and the dura mater the convex surface of the brain was seen to be very dark over the greater portion of its extent. The dark color was most noticeable on the left side, and here, especially over the anterior lobe, over the right middle lobe, was a relatively clear patch; and in this region the arachnoid was observed to be somewhat cloudy, and the vessels of the pia mater distended, enlarged and tortuous. The cause of the dark color was discovered to be an effusion of blood into the meshes of the pia. In the sulci everywhere, and at the base of the brain, this condition existed. In the lateral, third and fourth ventricles were thin, black clots, the blood in these situations having evidently escaped from the meshes of the pia because there it was subjected to a less degree of restraining pressure. The largest accumulation of blood in any place was around the medulla oblongata. The amount collected there was quite large — sufficient, as it appeared, to cause marked pressure upon the medulla. The brain substance was healthy in appearance.

Remarks. — This form of meningeal hemorrhage is said to be quite rare in adults, although not uncommon in new-born children. With so general a diffusion of the blood, we can hardly suppose that the bleeding took place from one point of rupture. The amount of blood was too great, and the time for its diffusion too short to admit of such a conclusion. On this point, it may be said that, from the best evidence obtainable, H. was alive and dressed at 3.45 P. M. He was found dead at 5.30 P. M., one hour and forty-five minutes later. At 6.25 P. M. the body had begun to show traces of post-mortem lividity, and the extremities were cold. In my opinion, the man had been dead at least two hours. This calculation leaves only forty minutes for the whole transaction, including undressing and the subsequent acts, and makes it certain that death occurred very soon after the hemorrhage began. From the wife of the deceased I learned that he had been drinking freely for a year or more. He had, however, she said, seemed to be in good health, and had had no recent illness, except an attack of vertigo, or something of the kind, about one week before his death. The alcoholism accounts, of course, for the fatty liver and the varicose state of the cerebral blood-vessels. From the position of the body when found, and other circumstances, it seems almost certain that the hemorrhage took place while the man was in the act of sexual intercourse, and that death, as I have said before, speedily followed. We may account for the occurrence by supposing that the excitement attending sexual intercourse caused an intense fluxionary hyperemia of the brain, and that the dilated and weakened vessels of the pia, already in a state of chronic engorgement, were unable to bear the additional strain, and gave way at numerous points, causing the fatal hemorrhage. The suddenness of the death was probably due to the pressure upon the medulla by the large effusion around it. If it be allowable to assume that, owing to the pressure respiration was first paralyzed, the heart continuing to act for some minutes after breathing ceased, we may in this way account for the black state of the blood, death being due, in a sense, to asphyxia.

IDENTIFICATION OF A HUMAN SKELETON.[1]

BY ROBERT BURNS, M.D., OF PLYMOUTH, N. H.

On the 15th of October, 1895, a resident of Landaff, N. H., while working in his cellar, found a skeleton. Suspicion of murder soon fastened upon one Milo Grey, who had once lived in this house, and whose wife had suddenly disappeared some four years before. This man was arrested and indicted, but shortly before the time set for the trial, he pleaded guilty of murder in the second degree — claiming first, that he killed his wife on September 11, 1891, which we know to be the date of the woman's disappearance; secondly, that the fatal deed was done by a push which sent the victim sideways from the carriage seat to the ground; that she struck on her head and never moved afterwards. I would call to your notice that the time which elapsed between the murder and the finding of the remains was only one month over four years.

This house in Landaff is a small, old, wooden structure, in size about thirty feet by eighteen feet. It is a long distance from any other habitation; is situated on a soil in which gravel predominates, and on a level spot, the land at one side of which slopes enough toward a brook some two hundred feet away, to ensure good natural drainage. Owing to the situation of the house, I think it unlikely that there would at any time be standing water in the cellar.

The house was originally built without a cellar, the foundation being of such stones as could be most readily found for the purpose, and gathered evidently with more reference to size than to shape, consequently the interstices of the so-called cellar wall were much larger and the interior was more exposed to the weather than would be the case under ordinary conditions.

The so-called cellar was really an excavation made at some time subsequent to the building of the house, within and smaller than the house area, and the usefulness would probably depend upon the thoroughness with which the common winter custom of "banking up" the sills and foundations was carried out. You will see that in an unoccupied house of this character the range of temperature in the cellar would be practically that of out-of-doors, and would therefore be much greater than would be expected without a full understanding of these conditions. It is also to be remembered that the winters are decidedly more severe than those to which you are accustomed. As the body

[1] Read at the Annual Meeting, June 9, 1896.

was only lightly or partially covered with earth and stones, it was fully exposed to all temperature extremes.

It was found upon inquiry that in the spring of 1892 a stench had been noticed by those passing the house, which was unoccupied at the time, and "two years later" when the house was again inhabited, the stench had disappeared but "after a rain when the house was closed a disagreeable odor was noticed on opening."

Enough of the clothing remained, though mostly merely shreds, to assist in the identification of the body. Several witnesses recognized a pin, a ring and some peculiar metallic buttons, which were found with the remains, and which also an old photograph in part reproduces. The right foot was still encased in an ordinary buttoned boot; within this the stocking was in much better preservation than the other textile clothing, and the foot was mummified, whereas the smaller bones of the other foot had to be recovered by sifting the soil.

The body was found lying face downward on the cellar floor. Upon the left side of the head, was a large fracture extending upward across the vault of the skull and backward to the external occipital protuberance.

When I first saw the skeleton — it had already been moved to Woodsville — the full number of bones had not been found, and the earth where the body had lain had already been spaded, so that we were obliged to carefully sift all earth, to a depth of six or eight inches in that part of the cellar, in order to find the small bones, and the very small amount of hair which we were finally successful in recovering. By this careful searching and sifting, the smaller bones were ultimately all found; but very little hair was found with or near the remains. When the skeleton came into my custody, shortly after this time, I found, among the *débris* attached to the bones, a small piece of scalp, with a number of brown hairs about an inch long, hairs straight and with cut ends. This hair was beyond question human hair.

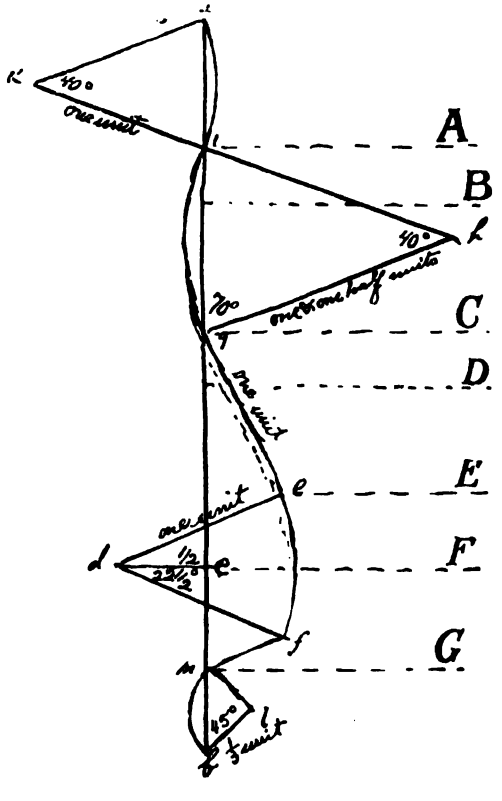
When the skeleton was sent me, I was asked to examine it and to form an opinion as to the age, height and time since death.

I have already alluded to the cranial fracture, and the skull was also noticeable on account of the absence of the four upper incisors; and as the lower incisors were in normal position, and the lower jaw firmly articulated, the vacancy was marked and could be easily shown to a jury. From the disappearance of the epiphyseal lines, the condition of the sternum, sutures and teeth, the body was that of an adult.

In determining the time since death, the following points were noted: A good share of the interarticular fibro-cartilage had disappeared. The internal condyle of the left femur was almost wholly destroyed. This destruction began some two inches above the lower edge of the condyle and the bone was destroyed well down into the cancellous tissue, making it look as if the bone had been eaten. The remainder of the bone was in good condition and was not attacked in any way. The destruction took place above the articular surface of the condyle. The left zygoma had also disappeared, but presented

the appearance of having been broken off. The ligaments of the right ankle still held in place the tibia, fibula and foot, which you remember was found inside a boot. Some of the transverse processes of the vertebræ were slightly injured. The conclusion drawn was that without the additional evidence of the stench the time the bones had laid there could not be accurately determined, and that the destruction seen in the condyle and at some other points, was more than was to be expected, judging either by the condition of the rest of the skeleton or by the time indicated by the other evidence.

The height was determined by following the directions in Dr. Dwight's essay on "The Identification of the Human Skeleton." The first task was to articulate the spines. In his essay Dr. Dwight says, "Draw a vertical line about the length one would suppose a vertical line *a b* to have, passing from the top of the atlas to the tip of the coccyx." This was done; and after drawing several lines and making the curves, a line twenty-five inches in length was decided upon, or a line about five times the length of the straight line in Dr. Dwight's small diagram. The accompanying diagram will serve to recall the method. If this is correct, the middle of the line will fall opposite the eleventh dorsal; the first and second quarters opposite the lower border of the third dorsal; *c* at the lower edge of the fourth lumbar; *i* at the lower border of the sixth cervical; *g* at the upper border of ninth dorsal; *e* at lower border of second lumbar; *m* at the middle of the third sacral. In addition to this, each region must have its proper share of length in accordance with the tables for the different regions. The curve thus made is supposed to be that of a person in standing position.



The diagram was drawn on heavy manilla paper and then cut with a sharp knife, short intervals being left to give the paper stiffness. A long box was filled with sand, and the paper laid upon it, and the curve traced through with the knife, but no impression

could be obtained that was satisfactory until the sand was wet and well packed down. Then a clear and distinct impression was made. This was filled with plaster-of-Paris and gave a sharp and clear white line. Matches were placed at the points mentioned above, and the bones were laid in the sand, which was deep enough so that the sacrum could be buried half-way. The greatest amount of trouble was found at the points marking the sixth cervical and the third dorsal. The work was checked by taking measurements of each region and finally of all. The vertebræ when arranged differed little from the diagram. There was a tendency in the dorsal region to follow a slightly straighter line than the curve plotted. At the point of greatest difference they were probably a quarter of an inch away from the line. When the bones were arranged the variation in the dorsal region and cervical regions from the point where the sixth cervical and ninth dorsal should fall was about half an inch. When the line had been found satisfactory, it was traced upon a board and an iron rod bent to it. The vertebræ were then placed in position, strips of buckskin being used to represent the cartilages. Enough of this skin was prepared to give the proper amount of cartilage to each region, and then the table for the amount was followed, the mean being taken. The bones were firmly fixed by wiring together the processes so that they could be handled without displacing them. The mean length of the region by the table amounts to 23.3 and the measured length when finished was 22.2. (See Table.)

Spine.	Mean Per Cent. of Cartilage.	Mean Length of Region.	Absolute Length of Bone.	Absolute Length of Bone, and Mean Per Cent. of Cartilage.	Measured Length.	Difference
Cervical	41.9	5.3 in.	$3\frac{3}{4}$ in.	$4\frac{7}{10}$ in.	$4\frac{5}{8}$ in.	$-\frac{5}{40}$
Dorsal	26.4	11.2	$7\frac{3}{8}$	$9\frac{6}{10}$	$10\frac{3}{8}$	$+\frac{31}{40}$
Lumbar	44.6	6.8	$4\frac{9}{10}$	$7\frac{1}{11}$	$7\frac{1}{8}$	$+\frac{1}{40}$
		23.3		$21\frac{2}{5}$	$22\frac{1}{8}$	$+\frac{32}{40}$

In placing the pelvis in position, the following points were observed: The anterior spine of the ilium will fall in the same vertical plane as the symphysis pubis; the base of the sacrum should be nearly four inches above the plane of the symphysis pubis; the apex of the coccyx a little more than one-half an inch below its lower border; the posterior part of the cotyloid notch should be the most dependent part of the cotyloid brim; make a line from the top of the symphysis pubis to the middle of the third sacral vertebra, form an angle of 30 degrees to the plane of the horizon; the angle of

inclination of the pelvis to the horizon is 60 degrees; the highest point of the great trochanter is three-quarters of an inch above the level of the pubes.

The operation of puncture of the subdural space in the lumbar region of the spine has become a recognized diagnostic method. An easy method suggested by Jacobi is "to draw a line between the highest points of the cristæ ilii: such a line will pass through the centre of the fourth lumbar vertebra." After the pelvis and lumbar vertebræ were articulated and in position it was found that a line drawn between these two points fell upon the fourth lumbar vertebra, proving that our articulation of this position of the skeleton was correct.

The bones of the foot, ankle, tibia and fibula were held together by ligaments, and the femur was easily placed in position. The results of the measurements were as follows: The actual measurement from head to foot was 61 inches, the centre of the height falling a quarter of an inch above the symphysis. The length of the femur was 15¼ inches, measured from the tip of the great trochanter to the lowest point of the condyles, making it one-quarter of the whole height of 61 inches. Gould gives a measurement of the spine of the seventh cervical to the top of the head which is .148 of the entire height. This was 9⅜ inches in the present skeleton, thus making a height of 63 inches.

The conclusion drawn from all the measurements of the skeleton was that the person was about five feet two or three inches high.

It was to have been in evidence on the part of the State that the missing wife of the prisoner was a woman of about five feet and two inches in height; that her hair was brown and she wore it short; and that she had lost her four upper front incisors.

I think the case an interesting one because the time that the bones were in the cellar is known; because there was such a noticeable destruction of bone-tissue; and because the height determined by Dr. Dwight's method is shown by the evidence, corroborated by the prisoner's confession, to have been approximately correct. The results point to the accuracy and value of Dr. Dwight's essay.

CRIMINAL ABORTION.[1]

BY E. G. HOITT, M.D., OF MARLBORO
Medical Examiner.

THE distinction observed in medicine between the terms abortion and premature birth is not recognized in law. By the term abortion, or miscarriage, as used in criminal law, is understood the unlawful termination of pregnancy at any period of gestation. For the purpose of discussion, which it is hoped may follow, the subject will have no subdivision, but be distinguished as criminal abortion.

In considering this subject, it should not only be of interest to the medical profession, and capable of being discussed by them, but should be more seriously considered and discussed by the legal profession and educated representatives of the laity. It is not the object of the writer to bring out any new feature relative to etiology or treatment of abortion, but to obtain an answer, if possible, to the frequently recurring questions, why criminal abortion should be so common, and why the perpetrators are so rarely brought to justice.

A discussion of this trite subject would be useless to-day, were it not possible to cite cases showing the facts upon which we base our arguments. Therefore, I will briefly report the cases of criminal abortion coming to my notice during my practice and twelve years of service as a medical examiner of this Commonwealth.

CASE I. Mrs. R. had not lived with her husband for two years prior to her death, and during that time had resided under the same roof with her attending physician. It was proved in court that she was his mistress. A miscarriage at two months was followed by septicemia resulting in her death. The physician, having a questionable character, the authorities of the town in which he resided, demanded an investigation, and officers were detailed to shadow the accused until the results of an examination should be made known. Officers saw defendant in private conversation with me before making the autopsy.

Autopsy was made in presence of three medical witnesses of good repute. The abdominal cavity contained the characteristic products of peritonitis; the intestines were agglutinated at several points; there was a perforation of the uterus at the fundus posteriorly; the secundines and *débris* were found in the uterine cavity. I gave the primary cause of death to be miscarriage.

[1] Read at the Annual Meeting, June 9, 1896.

As I was about to leave the house, officers saw the accused offer me money —also attempt to force the same into my hand and pocket. The case was now one of adultery, malpractice and bribery. The doctor was placed under arrest, giving $1,500 bonds for his appearance before the grand jury.

A few days after his release on bail, he left his unsatisfied bondsmen. So far as I can learn, no legal efforts have been made for his return.

CASE II. Miss. C. miscarried at three months. Having been told by her attending physician she could not recover, she made the following ante-mortem statement:

Knowing she was pregnant, she went to Dr. ——, who, for the small consideration of five dollars, used an instrument for the purpose of producing a miscarriage. She described the instrument as a wire slightly bent, having a black flat handle. This was introduced into the womb, and twisted around several times, causing her pain in the abdomen, also causing her to flow at once, to such an extent that the doctor was obliged to loan her his office towel, while she returned home.

The patient died five days after the operation. The autopsy verified her statement. The doctor accused was arrested, placed under bonds, and made his appearance in court. The case was continued from term to term, and finally dropped from the calendar. The doctor has since departed this life. It is hoped he may meet with the same leniency when he appears at the bar of judgment in the Higher Court.

CASE III. Miss B. miscarried at four months. Pains and loss of blood continued. Delay in shedding the secundines placed her in such physical condition as to make her recovery doubtful in the mind of her medical attendant, who made her acquainted with her condition. In consequence, she, feeling that she was about to die, made an ante-mortem statement of the following facts: She had been keeping company with, and supported by, a married man (giving his name). Learning that she was pregnant, he procured from a druggist pills and other medicines which were used with negative results. He then performed an operation by introducing into the womb a red tube having a white bone knob on the end. This tube was retained by a sponge, fastened to a string.

She made a slow but perfect recovery. The defendant was arrested, but the case never came to trial.

CASE IV. I was summoned, in company with the clerk of the court, for the purpose of taking an ante-mortem statement from Mrs. A. I learned the following facts: She had not lived with her husband for six months prior to her sickness, which was due to an aggravated miscarriage at three months. She stated that she went to Dr. ——'s office for the purpose of getting rid of a child, and for no other purpose; that the doctor operated upon her with an instrument, the description of which answered to a uterine sound, which he passed into the womb; that he charged her ten dollars, and told her if it was not successful to call again. She submitted to two subsequent operations, after which she miscarried. Becoming alarmingly ill, and not improving under the

care of the operator, her friends dismissed him, calling other physicians, who informed her she could not recover. She did recover, however, and was a witness against the doctor.

The doctor convinced the court that he did not know she was pregnant — that he treated her for malposition of the womb. He showed to the court the instrument used, which was one usually and frequently used for replacing that organ, and said that in so doing he must have aggravated a miscarriage. One of our colleagues testified that the woman called at his office on the same date she made her first call on Dr. ——, that the object of her visit was to have an operation performed to rid herself from pregnancy. She verified this statement in her testimony, by stating that she went from this doctor's office to Dr. ——. The court discharged the defendant.

Case V. From Miss W.'s attending physician, I received the following history: The patient was four months pregnant. She had been operated upon by some unknown party. The physician in attendance had induced the patient and her mother, in presence of a witness, to sign a paper (which he showed me) exonerating him from malpractice. The patient died while I was in the room. Little or no publicity was made of the case.

Case VI. Mrs. T., the mother of eight children, having passed the menstrual period for the second time, feared she was again pregnant.

She went to a lady friend, having the reputation of successfully performing operations with a jeweller's brass blow-pipe. The operation, no doubt, was successfully performed, but unfortunately the patient died on the eighth day. The history of this case I obtained when I was called to curette the uterus. I found the patient dead on my arrival. No publicity was made of this case.

Case VII. Miss C., aged seventeen years. Diagnosis by attending physician was ovarian cyst. I was called to verify diagnosis and perform ovariotomy. The attending physician, having unlimited confidence in the statements of his patient, did not make a digital examination. I found her six months pregnant. She was housed and operated upon in this city, making good recovery in ten days.

Case VIII. Miss G., aged twenty, was brought to me by her attending physician to make differential diagnosis between pregnancy and abdominal tumor. I learned that she was five and a half months pregnant. This girl was successfully operated upon; when and by whom, her physician and myself could not learn.

During the past two years, in hospital and private practice, I have operated upon 23 salpingitis cases. I am deeply indebted to the attending physicians, who have so kindly aided me in gaining the confidence of the patients sufficiently to learn the exciting causes; 17 were secondary to a miscarriage (nine of which were induced), four to gonorrhea, and two unknown.

These are, indeed, woful but true pictures to gaze upon. Shall we allow this evil (which has already assumed stupendous proportions) to continue to grow? Should we allow the lawless liberty of advertising in our daily papers to remain a source of danger to the innocent and uninstructed? By our

silence, are we doing our duty as medical examiners? Are we not giving our consent, and does it not have a tendency to depreciate the dignity of the profession we represent? It remains for us, as guardians of the public health, to agitate the matter, and to suggest means which may be of assistance in governmental interference, in quenching this ever-growing evil.

The only explanation which can be given of the small number of convictions, in comparison with the number of cases in which crime is believed to have been committed, lies in the secrecy with which the crime, in its very nature, is surrounded; also in the fact that such proofs as are attainable, rarely do more than cast a strong suspicion of guilt upon the person charged with the offence.

In looking up the law relative to the administering and sale of drugs and instruments which are assumed to have the power of causing abortion, I find it reads:

"A physician is guilty of criminal malpractice when he administers drugs or employs any surgical procedure to commit any crime forbidden by statute. He is also guilty when he wilfully or intentionally employs any medical or surgical procedure calculating to endanger the life or health of his patient, or when he wilfully or intentionally neglects to adopt such medical or surgical means as may be necessary to insure the safety of his patients.

"A person who manufactures, gives or sells an instrument, medicines or drugs, or any other substance, *with an intent that the same may be unlawfully used* in procuring the miscarriage of a woman, is guilty of felony."

Now, it would be hard to prove criminal intent on the part of the advertiser in our daily papers, from the fact the same drugs and instruments might be used legitimately.

The sum total of the matter, therefore, is, that a person cannot give or sell any thing with the intent of causing a miscarriage. Still he may openly advertise the same article, as it is not the business of the public press to inquire in regard to the therapeutic properties of a drug or instrument. The answer of the party who sells or prescribes will ever be that the drug or instrument was not intended to be used for criminal purpose. This answer will usually be satisfactory to the court, since any drugs or instruments causing the uterus to empty its contents have other therapeutic properties.

We possibly could not frame laws that would be more stringent than those now in the code. It seems as though sufficient legislation exists to prevent such a crime, if the law was properly enforced.

Crude and unfinished as this paper may seem, the writer has been stimulated to present it to-day, from the fact that observation has impressed him with the belief that a discussion of "criminal abortion" may awaken an interest in the Medico-Legal Society. He has, therefore, with diffidence, attempted the duty and jotted down the preceding thoughts, as they suggested themselves, and now gives them to you, in the hope that they may at least awaken your interest, in a subject of no small importance.

THE LEGAL VALUE OF DYING DECLARATIONS.[1]

BY DANIEL MARCH, JR., M.D., OF WINCHESTER.
Medical Examiner.

DYING declarations, as defined by the American and English cyclopedias, are statements of homicide made by the victim under the solemn belief of impending death. The effect of such belief is regarded as equivalent to the sanctity of an oath. Declarations so made are substitutes for sworn testimony, and they must be such narrative statements as a witness might give on the stand if living.

The importance to the physician or medical examiner of a knowledge of the subject of dying declarations was impressed upon my mind by a case of death from criminal abortion which occurred in my district about a year and a half ago. In this case the accused was brought to trial and convicted. During the trial dying statements of two different persons were offered in evidence. In one case this evidence, if admitted, would have been favorable to the accused; in the other, to the prosecution.

I will narrate as briefly as possible the case to which I refer, and from this illustration, try to define what constitutes a dying declaration, what circumstances are necessary to make it valid, and how slight an error or oversight may throw it all out as inadmissible.

On the evening of November 20, 1894, a physician in Woburn telephoned me that he was in attendance upon an unmarried girl upon whom he had reason to suppose an abortion had been done, and that she would probably die. She did die the next night. I viewed the body the following morning, November 22d, inquired into the circumstances of the sickness and death, and made an autopsy at the undertaker's the same afternoon. From the physician in attendance and from the family of the sister at whose house she died, I obtained the following facts.

Petrina Matson, single, domestic, aged twenty-one years, born in Denmark, discovered in September, 1894, that she was pregnant. She was taken by her lover to some place in Boston, where an "operation" was performed October 24, 1894. She was then sent to the house of a "nurse" for care. Her sister and her relatives, missing her, made diligent search, and after ten days found her at the house of the so-called "nurse." They brought her home to her sister's house in Montvale, Woburn. Dr. Chalmers was called to attend her. He found her with symptoms of septic peritonitis — abdominal pain; fever; thin, mucous diarrhea, and a foul, dark, bloody discharge from

[1] Read at the Annual Meeting, June 9, 1896.

the vagina. At times she was seemingly a little better, but gradually became worse until, twenty-eight days after the operation, she died.

She had been very reticent during her last illness; she would make no statement to the physician and did not think she was going to die. She had, however confided to her sister something about the operation.

The autopsy showed the body of an emaciated girl, abdomen rather sunken, vagina large enough to admit two fingers, a very foul discharge from the vagina, the uterus of normal size, the neck of the uterus on one side lacerated its entire length as if rudely torn by some instrument, catarrhal inflammation of the mucous membrane of the entire intestinal tract.

The history and post-mortem examination justified a report of "death from septic fever, the result of criminal abortion." After some weeks, Police Inspector Cogan arrested "Dr." Henry E. Bishop, *alias* "Dr." Herman, of Tremont Row, No. 7, *alias* "Dr." Bailey, of 48 Howard Street, Boston. After tedious preliminary hearings, the grand jury promptly indicted Bishop for criminal malpractice in causing the death of Petrina Matson, and in another indictment charged Bishop also with another similar offence in the case of a colored girl, Florence Adley, who died in the City Hospital, Boston.

At the hearing of the latter case, the house-officer who had charge of the patient at the City Hospital, was called to testify; and he said that the girl, being very ill and feeling that she should not recover, stated to him the facts about the operation, and that it was done by Bishop. Afterwards, however, she felt a little better, and said to some friends, or persons at her bedside, that "she hoped to get well." This expression was sufficient to entirely negative her first statement as a dying declaration, and the whole was ruled out as inadmissible.

In the Matson case, the witnesses were the young man who had been arrested as accessory, who took her to Bishop's office and paid the fee, the physician who attended at her home, the medical examiner, and the girl's sister. The defence was evidently very anxious to put this latter witness on the stand. She had talked with her sister during her last illness; she had heard the whole story; and this she was prepared to relate. But the judge questioned her so closely in regard to the circumstances that the witness was obliged to admit that her sister did not know that she was so seriously ill, and did not know that she was going to die. Therefore, this evidence was merely hearsay and not a dying declaration; and the witness was not permitted to testify in regard to any conversation, whatever it may have been.

The jury brought in a verdict of guilty in the Matson case. Some months later, January 7, 1896, the exceptions having been overruled by the Supreme Court, Bishop was sentenced to the State Prison under the Indeterminate Sentence Act of 1895 (Chap. 504, Sect. I). The minimum term of his sentence was fixed at seven years; in case the court has any power to sentence definitely, his term was made ten years.

The court said that it could not help feeling that a man who attempted to perform operations of the kind that defendant attempted, ought to have the

skill commensurate with the task, and that the business as carried on by the defendant, who, as appears was once a butcher and then a policeman before he practised such operations, was nothing less than pure butchery. Accordingly his sentence was made severe.

It is important for the physician in attendance upon a woman likely to die from the results of a criminal abortion, to have clearly in mind his legal position and responsibilities. I quote a few of the acknowledged principles which have a bearing upon such cases. Dying declarations are accepted in law without being sworn to. It is naturally presumed that all statements made at such a solemn crisis must be sincere, believed at heart to be true by the dying person, even if subsequently shown not to be so.

The attending physician under such circumstances having expressed the opinion that the patient is dying and in sound mind, a magistrate should be summoned to take down the statements that the dying person may wish to make. Should it not be possible to obtain the services of a magistrate, then the attending physician can take down the dying declarations. The physician should, however, limit himself to writing down the exact words of the dying person, without offering any interpretation whatever. The statements should be read over to the dying person, and, if possible, her signature obtained.

The declarations must be made, not simply *in articulo mortis*, but under the sense of impending death, without expectation or hope of recovery. They are admissible even though others may not have thought the person would die.

The declarations may be signs or other appropriate modes of communication. It is not necessary that the examination of the dying person should be made after the manner of interrogating a witness in the case, although any departure from that mode may affect the value and credibility of the declarations. It is no objection to their admissibility that they were made in answer to leading questions, or were obtained by pressing and urgent solicitation, but the declarations must be made under a sense of impending dissolution. It does not matter that death failed to ensue until a considerable time after such declarations were made.

Declarations of a deceased person are admissible only in reference to those subjects to which she would have been competent to testify if sworn in the case. They must, therefore, in general, speak to facts only and not to mere matter of opinion, and they must be confined to what is relevant to the issue.

The circumstances under which the declarations were made are to be shown to the judge, it being his province and not that of the jury to determine whether they are admissible.

If the deposition of the deceased has been taken under any of the statutes on that subject, and is inadmissible as such for want of compliance with some of the legal formalities, it seems that it may still be treated as a dying declaration if made *in extremis*.

A REPORT OF THREE DEATHS FROM HEAD INJURY.[1]

BY FREDERICK H. BAKER, M.D., OF WORCESTER,
Medical Examiner.

THESE three cases are reported to the Society, not on account of their rarity but rather for the reason that each has certain interesting and practical peculiarities, and still more for the reason that they collectively illustrate anew the well-known fact, that fatal violence may be applied wilfully or otherwise to the head, leaving externally little or no evidence of the intracranial damage which it has accomplished.

Medical examiners are not infrequently called to act upon cases of this character where the objective evidence is very slight, and where, for obvious reasons, a truthful history is not given, and it is only by most rigid examinations and often by autopsy alone that we escape falling into grievous error.

CASE I. I was summoned by the Police Department about 1 A. M., November 13, 1895, to investigate the cause of death of a young man, H. E. D., who had died suddenly upon the floor of a dance-hall a short time before my notification. Upon my arrival I found a number of young men present around the body, all of whom could tell how he was picked up apparently in a faint, and carried to the window for air; but as to the cause of his being on the floor they claimed to be entirely ignorant. They freely advanced several theories as to the cause of death, such as "heart disease," "a fit," and the "bursting of a blood-vessel in the head"; but all denied that there had been any quarrel.

Upon examining the body two things only were noticeable: marked pallor, and a slight swelling beneath the left eye, which his friends declared he received when he fell upon the floor; but a careful examination did not show any contusion or injury of the scalp.

Shortly afterwards it became known to the police that there had been trouble between the young man who lost his life and another young man named J. O'S., the quarrel starting from their pushing each other in their eagerness to reach the coat-room. They had been strangers up to this time; but after a few hot words they stepped out into the dance-hall, sparred a moment, when O'S. struck D. below the left eye, and when the latter bent over to seize his opponent by the legs he was dealt another blow just above the left ear. He sank to the floor, dying in a few moments without regaining consciousness. Neither had been drinking.

[1] Read before the Society, October 3, 1896.

The body was ordered to be removed to the City Hospital morgue, where I performed an autopsy about twelve hours after death.

Autopsy. — The body was that of an exceedingly well-built young man, aged eighteen, height five feet and nine inches, weighing about 160 pounds. Rigor mortis was present throughout the body. Pupils dilated eight millimetres, and equal. The discoloration about the eye was much more marked than at the time of the first examination. Upon taking off the scalp, which was perfectly normal, there was found a contusion of the left temporal muscle, there being a rupture of its fibres with an infiltration of semi-clotted blood over an area about the size of a cent, one inch directly above the external auditory meatus, apparently made by the knuckle of his antagonist. The skull was of normal thickness. There was no extra-dural hemorrhage, and the dura itself was normal; and on being removed two or three ounces of very reddish fluid (blood and cerebro-spinal fluid) escaped, and a thin clot of blood was seen spreading over the lateral surfaces of both hemispheres, dipping between the convolutions, especially over the motor areas, and extending downward toward the base, where a large fresh clot lay over the Pons Varolii. There were also numerous small areas of extravasated blood in the pia mater and subarachnoid tissue, away from the areas covered by the thin clot. It was not possible to find the vessels which had been ruptured, nor macroscopically was there any laceration of the brain tissue. There was no rupture of the venous sinuses or fracture of the skull, nor did the blood-vessels show any signs of disease. The brain substance and the ventricles were normal. The other organs of the body were normal.

Following my routine custom in all autopsies, cultures were taken from all the internal organs; but, as was to be expected in this case, with negative results.

The interesting facts in this case are (1) the suddenness of death, (2) that a strong, athletic young man should be killed by one or two blows given by a man of less than average strength and having no knowledge whatever of boxing, (3) that the blow which was probably the fatal one (the one over the ear), left no mark externally. J. O'S. was arrested and indicted for manslaughter by the grand jury. As it had been ascertained that the deceased was the aggressor, and that there were many extenuating facts in favor of the defendant, he was allowed his freedom on probation.

Case II. This man, A. J., died as the result of a faction fight in the street between Swedes and Finns on the outskirts of Worcester on the evening of December 2, 1895. Parties of both nationalities were in a saloon drinking when the quarrel started. Reinforcements were wanted, and the victim was summoned from his house near by; and he had not been at the scene of the row, which was transferred to the street, more than two minutes when he was struck in the head by a stone thrown by some one in the crowd. Later, at an inquest, evidence was given that showers of stones were thrown in the darkness by both sides; and it is doubtful if the man who threw the fatal stone

was aware where it struck. The injured man walked back to his house and complained of severe pain in his head.

However, he went to his work the following day; but the pain growing more severe, he was obliged to quit work. The pain grew worse. A physician was called, who examined his head carefully, but did not find a mark of any kind upon the scalp, or any objective signs of fracture. Four days later he became so wildly delirious that he required restraint, and was sent to the hospital, where he died the following day with all the symptoms of meningitis.

Autopsy, twelve hours after death. — A Finn, height five feet and nine inches, weight about 180 pounds. Rigor mortis very marked throughout the body. Another careful search failed to show any external mark of violence about the head. Upon removal of the scalp I found a condition almost identical with that of Case I, namely, a normal scalp with a contusion of the right temporal muscle over an area of the size of a fifty-cent piece. Directly beneath this was found a linear fracture through the entire thickness of the skull, without any depression, starting two and one-half inches directly above the external auditory meatus, running downward through the middle fossa, and ending in the petrous portion of the temporal bone in the external auditory canal, in which was found a small clot of blood. The dura was not ruptured, and appeared nearly normal. The brain revealed a most intense general purulent leptomeningitis, so marked over the area of brain around the seat of fracture as to conceal completely the gyri, which were everywhere flattened. The meningitis was particularly marked also at the base of the brain. The ventricles were slightly distended with a purulent fluid which was not bloody. The brain substance was very slightly lacerated, only at the point near the middle of the fracture. The corresponding part of the brain on the opposite side did not, macroscopically, show any evidence of laceration or contusion, nor did thin sections of the brain disclose any minute hemorrhages or other alterations. The only variation of the internal organs from the normal was what might be found in any case which had had a high temperature for a number of days. I made at the time of the autopsy cover-slip preparations from the purulent exudate to determine the nature of the infection, and found only one organism present, namely, the micrococcus lanceolatus. Cultures were taken from the various internal organs; but they remained sterile, showing that the infection was not a general one.

This case has certain peculiarities: (1) That a stone thrown with sufficient violence to fracture the skull through the base and lacerate the brain substance should leave no external mark of violence; (2) That a man should be able to work with so severe an injury.

Numerous arrests followed his death; but from the nature of the fight and the number involved, and the fact of the darkness at the time, there was not found evidence enough to hold any one for homicide.

Case III. This case is reported with the permission of the district attorney. On Sunday morning, September 13th, I was called to the Worces-

ter City Hospital, in my capacity as pathologist to that institution, to perform an autopsy upon a woman, A. H., who had died there the previous evening. Briefly the history given was that she had been drinking heavily the past few weeks, and, being ill, a physician had been called four days before her entrance, who sent her to the hospital as a case suffering from alcoholism. She was able to ride to the hospital sitting up in a hack, but appeared stupid. She had no paralysis whatever, and shortly after entrance she articulated perfectly in answer to inquiries. She got out of bed and stood up for a moment the day before she died. A few hours before death she became unconscious; her pulse became very weak, and Cheyne-Stokes respiration developed, this condition remaining to the end. The scalp wound was dressed antiseptically while in the hospital; but its apparently insignificant character and the fact that she had no paralysis led to the belief that the cerebral symptoms were due to alcoholism.

Autopsy, twelve hours after death. — A well-developed woman, aged thirty-eight years. Rigor mortis present. The only mark of violence about the body was a small lacerated scalp-wound about one half-inch in diameter and one and one-quarter inches above the external auditory meatus; the whole wound was slightly suppurating. Upon taking off the scalp it was found that the left temporal muscle beneath the scalp-wound was perforated, and it was also found that directly beneath this was a clean-cut circular hole in the temporal bone nine millimetres in diameter. There were lacerations in the dura mater at this point, one hole being about as large as the perforation in the bone, the other a small one near it produced by a spicule of bone. The skull was slightly thinner than normal, but not remarkably so. The inner table of the temporal bone was shattered and imbedded in the brain. At first sight, it suggested strongly a bullet wound. There was a slight amount of clotted blood outside and beneath the dura at the point of injury, but not so much as would be expected. The brain was punctured opposite the tear in the dura, and there was marked flattening of the convolutions over the whole left side. Just how far the brain was pierced could not be determined, as a cavity was found in the subcortical brain substance, beneath the point of perforation, about the size and shape of a lemon, extending into the frontal lobe. It was filled with clotted blood and yellow, softened brain-tissue. The meninges were markedly engorged with blood, but there was no evidence of suppuration. The other organs of the body were of normal appearance. Cultures from the organs were negative.

Upon finding these conditions at the autopsy I immediately communicated with the chief of police, who detailed detectives to investigate the case. This resulted in the arrest of the husband and a brother of the deceased. The brother confessed that one week before her death he had, during a wordy quarrel, struck his sister by making a lunge at her with an umbrella. The umbrella was obtained, and found to have a metal tip which exactly fitted the hole in the skull. The brother apparently did not realize the extent of the injury at the time, nor did the injured woman,

who ran down stairs, and was not confined to her bed until the following day.

This case is one where the absence of characteristic clinical symptoms of intracranial injury and the placing of too great reliance on the history given led naturally to diagnosticating the case as alcoholism. It was only from the fact that the husband gave permission to have an autopsy that led to the discovery of the real cause of death and the arrest of the assailant. He was subsequently sentenced to the House of Correction for the term of one year.

ON THE IODINE TEST FOR SEMEN.[1]

BY WYATT JOHNSTON, M.D., OF MONTREAL, CANADA,

Physician to the Coroner's Court, Montreal; Lecturer on Preventive Medicine and Medico-Legal Pathology, McGill University; Associate Member of the Massachusetts Medico-Legal Society.

If one were asked to instance a couple of medico-legal tests generally conceded to be sufficiently reliable to be accepted without hesitation as a positive proof of the condition they were presumed to indicate, one would not be unlikely to select as examples the hemin test in the case of blood stains and the recognition of spermatozoa in stains due to semen as fulfilling these requirements, when properly performed by competent persons.

While this is no doubt true, it has long been recognized that the technique at our disposal for the examination of spots supposed to consist of semen leaves very much to be desired.

It is by no means certain that all the stains sworn to from time to time as being seminal have really been such, so much does the testimony concerning these objects depend on the degree to which caution and experience have tempered the personal skill and acuteness of the expert. The identification of spermatozoa with absolute certainty, while easy enough in a fresh stain, becomes increasingly difficult with the lapse of time; and the incidental handling, washing or wearing of the articles of clothing, which commonly require this examination, makes it more and more problematical whether the spermatozoa can be demonstrated entire and intact.

There are numerous extraneous objects which are so like the detached heads and tails of spermatozoa as to mislead even those who are thoroughly experienced in the work. The generally accepted rule is that no body which simply resembles the head or tail of a spermatozoon should be considered as serious proof, and the search must be continued until perfectly formed and entire spermatozoa are recognized. The uncertainty produced by finding substances resembling these heads and tails in the specimens examined, may, however, lead the expert to prolong needlessly the examination of stains which are not seminal at all. Delays from this cause may have serious results in judicial procedure, simply by retarding or preventing the public exoneration of innocent persons wrongly suspected. We have also, on the other hand, the possible miscarriage of justice owing to the experts or juries attaching importance to incomplete proof, where the other circumstances of the case are such as to arouse strong suspicions, and must not lose sight of the consequences of abandoning a search for spermatozoa because they could not be promptly found.

[1] Read before the Society, October 3, 1896.

Thus, in addition to a possibility which cannot be altogether ignored that the bodies affirmed to be spermatozoa were not so in reality, we have the serious drawback that the expert can only feel perfectly certain that the stain is non-seminal after making protracted and laborious observations; these, if omitted, may leave a crime unpunished in the case of a genuine stain not received in good condition.

The difficulties mentioned do not imply by any means that the spermatozoa test is not a good one, but simply that it is not adequate for the task it has had to fulfil of being the sole and only recognized test for semen. What is evidently wanted is some simple, prompt, preliminary test, by which one could decide in a few minutes whether a given stain is likely to repay a search microscopically for spermatozoa, or not. At the same time such a test would evidently be still more useful if it was sufficiently accurate and distinctive to afford good corroborative evidence of the presence of semen, and so to guard against the possibility of the expert being led to regard as spermatozoa some entirely extraneous substances.

A test which appears in great part to fill those conditions has recently been announced by A. Florence, of Lyons, whose monograph entitled "Du Sperme et des Taches de Sperme en Médecine Legale,"[2] contains much besides that is of interest.[3]

Florence recommends the use of a reagent not infrequently employed for testing alkaloids, known as the ter-iodide or tri-iodide, of potassium. This reagent is a solution of iodine and potassium iodide, in proportions which correspond to the formula $K I_3$ but which is not a definite chemical combination. The formula recommended is as follows:

Iodide of potassium C. P. . . .	1.65 grammes
Iodine	2.54 grammes
Distilled water	30 c. c.

Good results can also be obtained by one-half the amount of iodine (1.27 grammes equivalent to $K I_2$), but the iodine must be in excess. The well-known Gram's solution is not suitable for the reaction. The solution keeps perfectly well in glass-stoppered bottles. It should be used cold, as warmth interferes with the reaction.

When a drop of the liquid obtained by moistening a seminal stain is placed alongside a drop of the above solution on a glass slide or watchglass, so that the edges of the drops come in contact, there appear almost immediately large numbers of peculiar, brownish-red, pointed crystals. These are rhomboidal, and resemble so closely in form, size and color the hemin crystals that they could readily be mistaken for them, though a careful examination shows points of difference. This comparison to hemin crystals will convey a better idea of their appearance than could be given by the most elaborate description, and will enable them to be distinguished from the crystals which are met with in seminal fluids. They also form small turnstile groups or crosses, in the manner which characterizes the hemin crystals.

[2] Archives d'Anthropologie Criminelle, January, February and March, 1896.
[3] It has also been published separately by Storek, Lyons.

According to Florence (and my own observations confirm his statement), the crystals are sparingly soluble in cold water and very soluble in warm water, reappearing again on cooling. On exposure to the air, they gradually disappear, but reappear on adding a fresh quantity of the reagent. They are readily soluble in ether, alcohol, acids, fixed alkalies and iodide of potassium; they resist solution in very weak ammonia solutions. For their formation to be typical and abundant considerable dilution is necessary, and I have found the degree of this solution a most important detail in making the test.

Dried stains usually give the reaction in a manner fully as prompt and typical as fresh semen, and I have been using as a demonstration specimen for class use a stain on cotton over twelve months old, obtained from a homicide case. Recently, the crystals have been more difficult to obtain in abundance, the reason being apparently the increased difficulty of obtaining a solution of the semen rather than an impairment of the reaction.

The exact nature of the crystals has not been shown, as far as I am aware; I have regarded them as some special crystalline form of iodine.

The nature of the substance which occasions the reaction has not yet been thoroughly established. Florence claims to have isolated from seminal stains a substance which he terms *viriespermine*, and which he regards as a distinctive body producing this phenomenon. He states that it does not correspond in reactions with the substance isolated and called *spermine* by Poehl. It is said to be very soluble and to resist completely the effects of ammoniacal decomposition.

By using a larger quantity of material, the reaction can be obtained in the test-tube, an abundant red or chocolate-brown deposit of crystals being thrown down. In this way the demonstration of the seminal character of a stain might even be made without the use of a microscope.

A single fibre teased out of a thread in a piece of cotton stained by semen is sufficient to give a profuse crop of crystals under the microscope.

As to the degree to which this reaction is characteristic of semen: Florence claims that it will not react with any of the other secretions of the body, such as blood, urine, sweat, saliva, tears, bile or milk, nor with pus or nasal or vaginal mucus. The secretion of the Cowper's glands does not give it. I have made a number of tests with the various substances mentioned above, and have always obtained negative results, or at all events have never obtained a characteristic reaction.

The sperm of animals is stated by Florence not to give the reaction, as far as his observations went, though these were not extensive. Personally, I have not tested this point with sufficient thoroughness to give an opinion; but as far as my observations go a pseudo-reaction of doubtful nature can be obtained with at least some forms of animal semen. This point is still, as far as I know, unsettled.

In respect to Florence's claim to priority, I think it can hardly be disputed. I can find no recent work on legal medicine in which any chemical test is given for semen. Wood[4] says, "There are no chemical tests by which seminal stains

[4] Vol. II of Witthaus and Becker's Handbook, 1894, p. 79.

can be recognized." Dixon Mann (1893), Strassman (1895), Vibert (1896, 4th Edition), Hoffman, Taylor, Liman and our other standard authors do not refer to it. Roussin indeed recommended for examining seminal stains the use of solution of iodine and iodide of potassium, but only for the purpose of staining the spermatozoa, and the fluid which he recommended (iodine 1, iodide of potassium 4, water 100) does not give the Florence reaction. Apart from Florence's work there is practically no literature on the subject except the older work of Orfila as to the odors obtained upon heating the stains or treating them with nitric acid.

Florence states that he started with the firm conviction that so unusual a fluid as semen, which had such well-marked physical peculiarities, must contain some characteristic chemical substance. Acting with this hypothesis in view he proceeded *seriatim* to test seminal stains with all the ordinary reagents used in obtaining chemical reactions, especially those found of value for recognizing alkaloids and those generally employed in physiological chemistry. By trying these one after the other he discovered several which gave him positive results, and among these he selected the ter-iodide of potassium as the one best adapted for medico-legal requirements.

During the past three months I have been making some observations on cadavers (22 cases) upon the occurrence of this reaction in connection with the secretions from the prostate, seminal vesicles, testicle substance and the post-mortem ejaculations from the meatus, with a view of determining whether the prostatic ingredient of the semen or the semen proper was chiefly concerned in giving the reaction. The material was obtained for the most part by allowing it to dry on cotton-wool swabs, so as to obtain a condition comparable with those under which seminal stains ordinarily come under medico-legal examination.

Pressure of other work has prevented me making these examinations with sufficient thoroughness to make their publication in detail seem advisable until I have gone over the material again more carefully, but the general results are as follows: Drying does not appear to interfere with the reaction materially within the time limits I have mentioned; and, in fact, I have often obtained the reaction more satisfactorily from moistening the dried secretion than from the original fluid. Decomposition, such as is met with in drowned bodies and bodies long exposed to the air, appeared to interfere with it to some extent, contrary to what Florence's observations would lead us to expect. The semen from the meatus or from seminal stains gave a better reaction than that substance obtained from the regions where the prostatic and testicular components of the semen had not yet mingled. Semen expressed from the prostatic duct into the urethra gave prompt and characteristic results, while these were much harder to obtain from the testes or the contents of the vesicles. So much was this the case that at first I thought the reaction might be due to the prostatic element of the secretion and not to the strictly seminal part. In some cases, however, typical results were obtained from the contents of the seminal vesicles and from the substance of the testicles. In two cases the reaction was imper-

fect or almost absent, certainly not sufficiently typical to justify medico-legal deductions, one being a case of cancer of the seminal vesicles and prostate, and the other double chronic vesiculitis with corpora amylacea very abundant in the prostate. In both of these, spermatozoa were present in the semen.

Hypertrophy of the prostate did not appear to affect the reaction. In one case the reaction appeared to be present before the period of puberty (seven and one-half years), though here it did not appear to be perfectly typical and satisfactory. I could not find it in the secretions of infants and very young children.

These few observations are not recorded here so much with a view of passing judgment upon the percentage reliability of the test as to indicate the direction in which observations might be made, as the total number of observations I have been able to make so far is not sufficient to justify general conclusions.[5]

With regard to the practical merits of the test, I think that those who use it for testing seminal stains will agree as to its decided value as a preliminary test, and accord it a position analogous to the guiacum test for the blood, by which we can promptly find out whether there is a probability of positive results being obtained upon further examination. Personally, if it was obtained in a typical manner, I should regard it as very strong corroborative evidence in a case where spermatozoa were claimed to be present.

With regard to its independent value as a test, Florence formulates his conclusions as follows:

(1) From the occurrence of the reaction alone, without discovering even fragments of spermatozoa, he would conclude that it was probably a seminal stain.

(2) From the coincidence of well-formed and typical but detached heads of the spermatozoa, along with the reaction, he would affirm positively the presence of semen.

(3) With *débris* of spermatozoa or even with perfectly-formed heads, but without the reaction, he would not feel certain that he was dealing with a stain produced by human semen.

It will be noticed that Florence attaches to the detached head of spermatozoa more significance than is accorded to them by our standard authorities. It must be mentioned that Florence has added materially to the data which may be used in identifying the heads of human spermatozoa, as the result of his careful study by means of oil immersion lenses and staining methods. By these more refined methods, highly characteristic details were brought out which would escape notice if ordinary dry lenses of moderate magnification were the only ones employed. The illustrations of spermatozoa given in his monograph are far superior to the illustrations which adorn the average medico-legal text-book, which are in many cases little more than caricatures. It must be remembered that the drying and subsequent moistening of the spermatozoa have a tendency to deform them somewhat, so that the appearance

[5] Two instances of advanced and well-marked disease of the seminal receptacles is obviously a very high proportion for only 22 cases. In both these two instances of organic disease the fact of iodine reaction being interfered with while the spermatozoa were still present indicates the greater certainty of the spermatozoon test.

obtained may not always be perfectly uniform. This tendency to deviation would, however, be more likely to cause human semen to be confounded with that of animals, than the reverse. Personally, my experience does not entitle me to express an opinion as to the extent to which detached heads and tails of spermatozoa should be allowed to constitute evidence of semen, but I think it will be a long time before anything less than the entire spermatozoon will be accepted as legal tender by either judges or juries.

I think it can be said with confidence that the iodine reaction of semen, as described by Florence, is a decided step in advance, and that in it we have a new and very promising preliminary and confirmatory test for normal semen, and one which gives relatively good results in the case of stains which from a prolonged drying, react with difficulty to the microscopic test.

The sources of fallacy which attend the iodine test are, however, as yet practically unknown.

To determine what inference may be drawn from the absence of this reaction in a suspected stain, we need much fuller information and experiments on the effects of external conditions, etc., upon substances known to be stained by semen; we also need information as to the extent to which pathological conditions may exert a modifying influence, how the age limit affects the reaction, and on many other points.

Before we can assign accurately the significance of a positive result, we require much further testing and corroboration regarding the behavior of the reagent with substances other than semen, and also with the semen of animals.

After making all due allowance for this we must rejoice at the success of M. Florence in discovering a crystalline reaction for semen. As a rule, a good crystalline is better than a color reaction and we may expect that further researches in this direction will lead to the discovery of new and valuable micro-chemical tests.

ON THE DUTIES OF A MEDICAL EXAMINER.[1]

BY HOSEA M. KNOWLTON,
Attorney-General of Massachusetts.

MR. PRESIDENT AND GENTLEMEN: — My experience is that success grows and results much more from men than from machinery, in any department of human activity, whether in business or in the workings of laws. It is the men who are entrusted with the work, rather than the machinery that is devised, that make or mar results.

I am glad to say this, gentlemen; although I have been an associate member of your organization for many years, it is the first opportunity that I have had of putting in formal shape my testimony to the very commendable exertions of the members of this body, and of the medical examiners throughout the State, to enforce the provisions of this law in the interest of justice in the Commonwealth.

It may be that my experience has been larger than that of living men. I have had to do directly and indirectly with the trial of thirteen indictments for murder, and the investigations of many more cases, and I have uniformly found the medical examiners with whom I have been brought in contact, whether in my own section of the State or elsewhere, to have that understanding, that intelligent understanding, of the duties imposed upon them by the Medical Examiner Act, that was necessary for its success.

As you know, the medical examiner system succeeded a system which had fallen into disrepute, and which had become worse than obsolete. This act was an immense advance in the business of detecting and punishing crime; and yet this act would not have been a success had it not been for the character of the men who enforced it.

That leads me to observe, also, that I am addressing a body of men upon the duties of an office which, so far as I am able to understand by my experience, they already well know. I also observe that from time to time, beginning perhaps with Mr. Tyndale, the author of the act and its most earnest promoter, who addressed this body twenty years ago, and from time to time by other officers concerned in the prosecution of crime, the duties of medical examiners have been very fully gone into; and I hardly hope to add anything to the intelligent discussion already had. But I am told by your secretary, who is responsible I suppose partly for my being here, that from year to year new members are added to your body who very seldom read the musty records of

[1] An Address before the Society, Febuary 3, 1897.

the past, and that it may not be entirely useless to consider some of the difficult features of the law. It has been said over and over again, and the remark has been put in capital letters in every case where your body has been addressed, that the main purpose of the law is the detection of crime. I assent to that statement, but conceive that the duties of the medical examiner are more accurately expressed if, instead of saying that "the purpose of the law is the detection of crime," we say that its real object is the ascertainment of the question of guilt or innocence. You can easily see the distinction, gentlemen. By far the greater number of deaths that occur, not from disease but from injury or even from violence, are not tainted with crime. But it is more important, perhaps, it is at least as important, that the fact of innocence should be determined as the fact of crime. And if that is understood, some questions which I am told, Mr. President, are troubling this body, will thus be easily solved.

It is not a question, when a medical examiner is asked to have a view, whether it will probably result in finding crime. The question, the only question, should be, Is there any ground of suspicion of crime? And the medical examiner discharges his duty as effectually when he, by his investigations, dissipates that suspicion and establishes innocence.

A woman dies from some disease which leads the neighbors and friends of the family to suspect an abortion has been committed. The medical examiner makes his examination, his view, or even his autopsy, if necessary, and establishes that that suspicion is unfounded. That result is as important to the Commonwealth as it would have been had he found crime connected with it. I speak of this because it has been suggested to me by more than one member of this Association that the question of whether to take a view, or not, is sometimes considered with reference to its expense. I will speak of that a little more, later; but I now refer to that in connection with the proposition that I am endeavoring to make, that it is not a question probably of the detection of crime. It is as much the establishment of innocence where crime is suspected by anybody.

I judge from some things that have been said, and no less by some of the addresses that have been made to this body in years gone by, that the first stumbling block in the way of the intelligent comprehension of the "Medical Examiner Law" is the expression, "death by violence." It is said that the term "violence" has been variously defined. And it may not be improper for me to try my hand at it. The word "violence" has a number of meanings, and perhaps in common conversation it may mean "force of any kind, innocent or guilty." But in the few moments that I was able to give to the preparation of this rather informal address (for I was told I could give that sort of address) I have examined the definitions of the word "violence," and find that in the "Century Dictionary" this definition, (in law that is, the definition that obtains in law,) is "Any wrongful acts of one person whereby either he or his instrument of wrong-doing is brought in contact with the limbs or body of another person." Also "unlawful use of

physical force." In the "Standard Dictionary" the same definition is given, "force unlawfully exercised." With that understanding, there is no difficulty in the jurisdiction, so to speak, the province of the medical examiner. He is to ascertain whether in any given instance death is the result of "force unlawfully exercised."

The analysis which I have attempted to make is probably not wholly logical or necessarily conclusive. It may not fulfil the etymological definitions of the terms used, but I divide them in this way: A death may be "natural" or "unnatural." As I say, that definition may be criticised according as you define the term "natural" or "unnatural." But those whom I am addressing have no difficulty in understanding what I mean. They are perhaps the most convenient words. If the death is "natural," there is no work for the medical examiner. He is only called upon to consider the "unnatural" death. "Unnatural" deaths may also be divided into two kinds: those which, for want of a better term, I have described as "accidental," and those which are the result of "violence." Here, again, part of the work or province of the medical examiner develops. In an "unnatural" death, if it results from accident, the medical examiner is relieved, if that is thought to be a fact. That leaves him only with deaths by "violence."

According to the definition now given, which may be divided into two classes, in our acceptation of the word, and as to which I am bound to say some confusion has arisen, even in the mind of the author of the act himself, "death by violence" may be when the "violence" is self-inflicted, or when it is inflicted by another. I do not understand that, if it is clearly established that the violence is self-inflicted, there is any occasion for the medical examiner to go further. Probably the confusion arises from the fact that, in practice, when it is once ascertained that the man contributed to the death, it is extremely difficult in most cases to determine in advance the evidence, beyond that of the medical examiner, whether the man or person who inflicted the violence was the victim of a homicide, or not.

But, in strict analysis, we reduce the duties of the medical examiner to "unnatural violent deaths," using the word "violence" as being usually limited to cases in which the "wrongful acts of another, unlawful, forceful acts of another, contributed." Of course, that does not always mean murder, as I need scarcely say to you. It may mean manslaughter, as where, by reason of insufficient care exercised by one having the duty of caring for a person under his charge (as by a father to his child) or neglect or exposure, admitted or allowed or practised, death results. There is no blow struck, but the crime has been committed — the crime of manslaughter. Again, the supposed instance I cited a few moments ago (death resulting from abortion), which is not murder or manslaughter, but it is a crime which it is your business in ascertaining to detect and punish. The medical examiner, then, having jurisdiction, having in his province the investigation of all cases of death supposed to be by violence, is charged with the duty, with the responsible duty, of first establishing the fact either of innocence on the one hand or probable

violence on the other hand, and the getting and preserving what is by far the most important evidence, that is, a death by violence.

You will observe that I, on the one hand, make your investigations final when the innocence is established, and on the other hand, only a probable conclusion when crime is ascertained. Of course, the machinery of the law steps in after your result, and determines the question of "guilt" or "innocence" in the usual channels. The medical examiner presents his investigations, what is before him, to the extent of reporting that in his opinion there has been crime, and then turns the matter over to another.

Now, what is the medical examiner's business? The law limits him by Section 10, of Chapter 26, of the Public Statutes: "He shall make examination upon the view only of such persons as are supposed to have come to their death by violence." That is to be considered in connection with the next section, which provides that "When he has notice that there has been found, or is lying, within his county, the dead body of a person who is supposed to have come to his death by violence."

Who is to make the supposition? I answer, anybody, anybody. It is not confined to an attending physician; it is not confined to the officers of the law. It is broad enough to include any good citizen who has knowledge enough under the circumstances to entertain a reasonable suspicion. Bear in mind that the object of the whole proceeding which is initiated by you is, if your results are clear as to innocence or guilt — the whole object is ascertainment of the fact; and the fact of innocence is of as much consequence as the ascertainment of guilt.

It has oft-times happened in the twenty-nine years that I have been concerned with the prosecution of criminals, that I have had occasion to order dead bodies taken up on suspicion, or that suspicion might be removed. There is a case reported by that very accurate and excellent officer, now deceased, William H. Taylor, of New Bedford, whom you may remember, where he caused the body of a woman to be exhumed after having been buried forty days. He had the stomach taken out, and the proper processes set in motion to ascertain whether an abortion had been committed. There had been spread abroad a suspicion that the woman had been poisoned. This could not be traced to definite sources; but the suspicions gained credence, as such rumors do, till he performed his duty of holding an autopsy, and he ascertained that the suspicions were ungrounded.

Come back, then, to the elucidation of the expression, "supposed to have come to their death by violence," and answer the question, "Supposed by whom?" I repeat the answer I made before, Every man who has a reasonable ground of supposing that the death is the result of violence has the right, and it is his duty, to communicate that suspicion to the medical examiner, and if he finds upon inquiry that it is honestly obtained, there should be an investigation to determine the truth. I conceive that it is the duty of the medical examiner not to consider whether he shall impose a cost of four dollars and travelling expenses upon the county, but to resolve the doubt; and

if he has resolved the doubt in favor of innocence, he has earned the money, and the Commonwealth or county can well spend that sum to have that suspicion allayed.

I am told that there is some hesitation on the part of some of your body as to how far they should proceed upon rumors; how far they should yield to the solicitation of those whose imaginations are inflamed by baseless suppositions. Bear in mind, gentlemen, that like all other remedial laws put into the hands of officers employed by the State to make the law, a great deal is necessarily entrusted to the sound discretion of those charged with its execution. This is why men of learning and experience are selected for that purpose. No one can lay down rules; the medical examiner must not be influenced by considerations of the county treasury, or by the objections of county officers against the expense, but by considerations which are founded upon his own good sense and experience. Bear in mind that the resolution of any doubt is far cheaper in the long run for the county and the Commonwealth than the expense of the view.

Then, assuming that he has been told — it need not be his own suspicion necessarily — that there are well-grounded suspicions on the part of any person that the death was by violence, the statute proceeds to lay down his duty. If it is within his district (and of course I cannot say that a medical examiner will go out of his district, but he will not refuse when time requires immediate action), two things are before him, which are successive in their nature, either one of which, or both of which, may lead him to the next step — that is, to ask for authority to hold an autopsy. The first is the "view"; and I may be permitted later to give some special suggestions about the view. Second, a "personal inquiry," which is not evidence, of course, but is of great importance in leading the medical examiner himself to a sound conclusion. And then, third, when, in his judgment it is necessary for complete satisfaction of the question whether there is guilt or innocence, the holding of an autopsy on the authority of the town officers or the district attorney. All these means are before him. Charged with the duty of ascertaining definitely the innocence, or, on the other hand, definitely getting a belief in violence (meaning by that expression "unlawful act of another"), he first views, then makes his personal inquiry, and then, if not satisfied (much more if he is satisfied of the fact of violence), the autopsy, to complete the investigation and have the evidence before him.

When he has made the report, either upon the view or personal inquiry alone, or upon the view and the personal inquiry and autopsy, that there either is no crime, or, on the other hand, that there is reason to believe there was "death by violence," his duty is discharged, his part of the duty is concluded.

I said just now, and perhaps I did not make myself well understood, that if upon the view and personal inquiry, the medical examiner is satisfied there was death by violence, it is much more his duty to hold an autopsy. The reason I say that is because then, upon that contingency, comes in another propo-

sition, that is the ascertaining of all possible evidence upon the subject. That leads to another branch of the duty of the medical examiner: the first is to answer the question of innocence or probable guilt; secondly, in case of the probability of guilt to obtain every possible fact that in any way bears upon the probable guilt. Of course the autopsy is the first and most obvious. Upon these questions it is impossible to assist one who is deficient by nature, and needless to teach one who is bright by the same divine gift. If a man is stupid, he cannot get the evidence. If he is bright, I cannot help him any. There are some gifted with the power of observation. I knew a man once who was specially employed in the prosecution of persons charged with "an unlawful selling of intoxicating liquor." He was called as a witness. I saw him a good many times upon the stand as a witness; and I ascertained that what made him a good witness was not faculty of language, but it was the ability of going into the liquor saloon or any other place, where he was charged with the observation of men, and afterwards telling everything there. It is the power of observation, a gift, an instinct. I don't know what can be done for one who has not that power. Frequently some officers will go into a place and be unable to tell what they saw; others tell everything. One is a good witness, and the other is not. Punishment of crime depends upon getting every possible fact that has to do with it; and medical examiners should understand that they have the first and best opportunity to get the facts bearing upon that question in a case of homicide.

I may be permitted again to refer by way of illustration — and I would not do it if he were now living, but he was my friend, and I am present now and he is gone — to refer to that case I have already alluded to. It was the Besse case, in Marion. It was where a man was found dead, shot through the head. An ordinary man would say that's about all there was to it. That, you would say, was the whole of it — shot through the head, where several buckshot had gone through and come out on the other side, and that was all there was of it. But read his report — what he saw when he got the peddler's cart in his possession. Every detail. It is astonishing how everything in relation to that wagon, the wheels, the mud of the wagon, the condition of the road where it travelled — all these details turned out to be of the utmost importance. The "view" is well done when it "views" everything.

The point I am trying to make is — and this is very likely a truism to most of you — that no man, not even the prosecuting officer, can tell in advance what is going to be important and what is not. And absolutely the only way to know is to appreciate and report and record everything — everything. For no man knows when any given fact may be important.

The same thing is true of the personal inquiry, although that is of no value as subsequent evidence in the trial of the case, for it is only for the satisfaction of the medical examiner himself. It cannot be used.

But when it comes to the autopsy — I venture upon ground which I travel upon with a great deal of timidity, for I am well aware that most of the gentle-

men to whom I am talking know better about that phase of it than I do, but I will venture this at least, it is not only the object of an autopsy to ascertain the cause of death, but also to exclude every other hypothesis of death. In the case I quoted, of the man shot — shot through the head by buckshot, which went in at one side and came out at the other — it looks as though that were enough. But no man can tell beforehand how important it may be to show that he didn't die of poison, or consumption, or derangement of the liver, or from some other disease. An autopsy is only satisfactory when it examines every vital organ, and is able to report negatively on all points but the one in question.

After you have got through with your report, it is, of course, then the duty of the medical examiner — I think it is not in the statute, but it is the obvious duty of the medical examiner — to assist the prosecution by furnishing to him, or to the grand jury, or the jury, the facts he has ascertained. That duty divides itself into two parts: one is the testifying to the facts. Every medical examiner, I need not say, will from the beginning, from the very beginning, put in writing everything he sees and finds, and have it where he can get it, for no man can remember these details.

And I repeat what I have said before, that the ascertainment of the facts, without any previous theory, without feeling, simply the facts that bear upon any given way of the homicide, that bear upon innocence, is most important. When every fact is taken, seen, recorded, and is testified to for delivery, that part of the duty is done.

I touch with more reluctance upon the other part of the duty of the medical examiner, for it is this perhaps which has been a subject of more reproach to the profession than any other department of the work, and that is giving sworn testimony, or evidence, commonly called "expert testimony." Perhaps I cannot better present my views than to say that I know a medical man whom I have often had occasion to employ, whose name, of course, I would not now mention, but who has achieved such a reputation for absolute truth that I have known many cases where he was called as a witness and not any one was called on the other side. Both sides have had such entire confidence in his absolute accuracy and honesty of judgment that I have not found a case where anybody has been called against him. Why? Not for his superior knowledge, but because the force of conviction upon all whom he comes in contact with is that he has not worked out a theory, but has only worked for the honest truth. The defect of expert testimony, I think, is less with medical examiners to-day than with those other departments of skill and learning; with those who testify to the value of real estate and matters of that kind; the defect of expert testimony is the almost inevitable and often unconscious tendency of experts to help the side that calls them. I say it is inevitable and unconscious. Both of these adjectives I use with design, for they do very much to relieve the expert of the imputation of blame which might otherwise be brought against him. The whole duty of the officer of the Commonwealth, charged with the detection and punishment of crime,

is to arrive at the truth, and when that standard is set up — "the truth, the whole truth, and nothing but the truth" as to your work — the results are the best attainable.

I have gone over in a very informal way those things that occur to me with reference to the duties of the medical examiner. I did intend to say one thing, and it is perhaps the only matter of detail I should refer to. I see it has been better said in some of the addresses of previous speakers in years gone by, and that is the importance of having the evidence where there is not any difficulty in getting at it. One of the most zealous, and in many respects ablest, of medical examiners that I have had to do with, was on one occasion so unwise — he will never be again — as to entrust the stomach of the person found dead to an express messenger to be carried to the chemist, and when it became necessary to prove that the stomach subject to analysis was precisely the same stomach taken from the dead body, the testimony of a dozen people who had handled the box was absolutely necessary. It was done without thought of the result; and it has not in my opinion marred the excellent record otherwise of that examiner. It is necessary that the evidence should be where it is certainly sure all the time. You understand that when you come to try a murder case, every essential fact must be proved beyond reasonable doubt. That is why I said that it is necessary to exclude every other hypothesis of a death, although the cause of death may be perfectly apparent on inspection. A counsel will suggest this or that hypothesis, and it is necessary to be prepared to show that the facts you have ascertained by the examination and autopsy are consistent with the conclusion you have here, and all are inconsistent with any other conclusion, and that there are no other facts consistent with any other theory.

DISCUSSION.

Dr. E. P. Hurd: I would like to have had the speaker more explicit on the question of suicides. If I understood the gentleman, when a medical examiner is called to a case where he finds a body, if it is a case of suicide, he has nothing to do with the case at all. Perhaps I misunderstood him. In a discussion before another association, the gentleman who read the paper at that time took the ground that this class of cases did belong to the medical examiners to determine the fact of suicide. The other case is the case of drowning, where the case is palpable: as where a child goes in swimming, or rowing in a boat, and there are half-a-dozen persons who saw the drowning accident. The body is brought ashore, and the medical examiner sent for. I would like to know, because I live on the border of a river near the shore, where we have more cases of death by drowning than through so-called "violent" deaths; I would like to know specifically — supposing I am summoned to go three miles to a drowning case, and there are plenty of witnesses who saw the party go in bathing, and perhaps brought the party ashore — what my duty is. Is it to obey the summons and get a report on the case, or satisfy

myself that there are no doubts that it is a case of accidental drowning? Is it my duty to report it or leave it unreported?

MR. KNOWLTON: Of course, the death by drowning illustrates the general proposition. A death by drowning is an "unnatural" death, and so far comes within the province of the medical examiner. Then I adhere to what I said, that if the fact of suicide is clearly established, there is no crime to punish and no occasion for further proceedings. I should say without doubt that whenever a case of drowning is reported to you, it is your duty to view the body, because nobody can tell so well as the medical examiner. He is the instrument of the Commonwealth to ascertain — the Commonwealth has appointed him to ascertain — whether it is death by drowning, or not. When he has ascertained by personal inquiry and by view, to his own satisfaction, he has no occasion to go further unless there are circumstances requiring him to go further.

In regard to the other question: I can only say as I said before that it is the medical examiner's business to go to the length of ascertaining whether "the unlawful act of another" contributed to the death. At any time when he becomes satisfied that the act of another did not contribute to the death, then his duty is discharged: because suicide is not punishable in this Commonwealth as a crime, the ingenious argument two years ago, to which I listened, to the contrary notwithstanding. The confusion in this rose out of the fact that the case of suicide presents a case where there is an obviously human force — human physical force — used, and the ascertainment of the fact becomes therefore more difficult whether it is the force of the man himself or some one else. After the view has settled it that it is the force of the man himself, and a suicide, then there is no crime. Of course, that addresses itself to the judgment of the medical examiner. He is to bear in mind that when he has traced out the end of the man — whether it is a man found dead in bed with a pistol-shot, and the pistol in his hand; or a case of asphyxiation, with the gas turned on; or any case of suicide — if the results of his view do not point clearly to suicide, of course, it is possible to go further.

DR. SAWYER: I should like to ask the attorney-general if his remarks are applicable to cases of burning. I did not understand him to answer directly another part of the question asked in the previous question, whether the medical examiner would in his opinion be justified in making a charge for such an examination?

MR. KNOWLTON: I did mean to say that every "view" should be charged; that the Commonwealth don't expect anybody to work for nothing, and the amount is earned by the investigation. The body has been killed by the hand of man or by the elements, and his charge is for ascertaining which one of these. "Burning" is an unnatural death; it may be death by violence or by accident, and he came to the "view" for the purpose of determining that question.

DR. SAWYER: There is quite a tendency, I believe, to call upon medical

examiners as experts in the courts in cases where medical expert evidence or opinion is necessary. I would like to ask the attorney-general if he would consider it at all detrimental for the medical examiner to appear in such a case as that, where he does not appear contrary to the interests of the Commonwealth?

MR. KNOWLTON: In civil cases I see no objection at all.

DR. SAWYER: There was one matter about which the attorney-general made the statement that a medical examiner should hesitate some little time before going into the district of another medical examiner, but that where cases demanded immediate action he should respond at once. Now I have been a little embarrassed. I have been summoned two or three times into surrounding districts when the medical examiner was not at home at that time — summoned by the legal officers or selectmen; in one instance, by the chief of police of the city of Fitchburg. Just how far ought a medical examiner to intrude upon the jurisdiction of another medical examiner?

MR. KNOWLTON: The law distinctly provides that, although medical examiners are appointed by districts, that provision should not be construed as preventing them from acting in any other part of the county. I think it does not extend to another county. So there is nothing in the law that will prevent a man who has one district in a county going into another district of the county. Two things are to be considered in answering such a question. The first is, that it often happens that the whole consequences may depend upon immediate action. For example (I meant to have spoken of this in my address), it happens in my experience to an unusual degree that the question of how long the body had been dead is liable to be of vital importance; and that, of course, can only be determined with any accuracy by an immediate "view." I think the experience in several recent cases has impressed upon the several medical examiners the great importance of getting the temperature of the body more accurately than can be ascertained by the somewhat fallacious nerves of the hands — some accurate measurement of the temperature. Secondly, his own immediate success will lead him to see where for any reason his services are more in demand than those of the medical examiner of the district; and if the alleged temporary absence of any other examiner is a pretence to get the more favorite examiner he will find himself judge. There is no law but the unwritten law of courtesy; the unwritten right of each man to have whatever belongs to his district is only to be overridden when for any reason whatever there is reason for special haste. This is not a good answer, but it is all I can give.

DR. MEAD: Is there any regulation as to when a medical examiner should make an autopsy?

MR. KNOWLTON: Fortunately, the law is pretty plain about that. It imposes it on the discretion of the medical examiner, "if after having viewed the body and made the special inquiry, he deems a further examination necessary." If he shall proceed to make an autopsy upon the authority of the district attorney, it then comes to the final discretion or the judgment of the man who

is commissioned by the governor to use his discretion. I say, answering the proposed question by examples more than by principles, Where he becomes reasonably satisfied, without an autopsy, that there is no violence, he should not have an autopsy. Where he is left in doubt, and he thinks an autopsy will help him, he should have it. Where the cause of death is apparently "the unlawful act of another," then he should have an autopsy, not for the purpose of satisfying himself as to whether there was crime or not, but for the importance of the evidence that may be developed by the autopsy.

DR. MEAD: There is a subsequent law which says that the fee shall be paid only when the district attorney shall certify that the autopsy was necessary. It takes it out of the hands of the medical examiner.

MR. KNOWLTON: I remember that law; and it was passed undoubtedly in consequence of the fact that one or two medical examiners (one that I knew something about — not living) I am sorry to say were in the habit of looking at pecuniary results rather than the cause of justice.

I do not know how far the experience of medical examiners can correct the statement; but in my experience, with perhaps one single exception, I have considered the judgment of the medical examiners to be better than my own. And I have never refused the certificate when the examiner has thought he ought to make the examination. The most that can be said is, that if the district attorney does not agree, the examiner has no fees. But there again I would suggest that when the question comes up as to whether a view is necessary, or an autopsy, he should proceed regardless of whether he is making the county an expense or not, and regardless of the fact whether he is going to get anything out of it.

ON THE DUTIES OF A MEDICAL EXAMINER AS A WITNESS.[1]

BY SHERMAN HOAR,
United States District Attorney.

MR. PRESIDENT AND GENTLEMEN: When I was at Cambridge, an instructor once gave out to six members of my class the same subject upon which to write a theme, giving us opportunity to read over each other's compositions, and telling us to then make our own compositions original, if possible. Then the Instructor took our papers, and read them out aloud to the class; mine happened to be the last one. When he came to mine, he asked me to read it, and I began. As I read he said, "That is true; but Smith has already said that." And then he took up the next proposition, and said, "That is true, but Sewall has said that." And so on, one page after another, with all my propositions, until he came to my name; then he said that was the original thing in my composition. I think when I get through, the name will be the only original part of my propositions. For, like the Attorney-General, I have not been able to prepare myself for such an occasion as this.

I entirely agree with the Attorney-General that the first duty of anybody connected with the prosecution of crime is judicial; that no person can properly, either as prosecuting officer or medical examiner, or as a witness, serve on a case except as a judicial officer in the first instance; and I think that is too often lost sight of both by prosecuting attorneys and by medical examiners. I think it is very essential for everybody first to ascertain the facts and to find out exactly what is true, and then to be able to express that truth in such a way as to convince twelve men of at least ordinary intelligence.

I have had little experience with medical examiners. I have tried but one murder case in all my life, and that is all I want to. In that murder case I had a medical examiner from this district who gave evidence, and a medical examiner from Halifax who gave evidence, and the difference between the two men illustrates exactly what I want to say. One of them had made his investigation as a judicial officer; the other had made his seemingly for his own aggrandizement. He had his own dignity to maintain; he had his own opinion to maintain. He had an absolute inability to make himself understood by any human being who listened to him.

Now you have not only to ascertain your facts judicially, to keep your mind open, to do what the Attorney-General said so well, "ascertain all the facts"; but I would like to add that not only should the medical examiner ascertain all the facts which the autopsy shows, but should be able to make twelve men selected almost at random understand what he means when he

[1] An Address before the Society, February 3, 1897.

states those facts. I have heard medical experts give testimony a great many times; sometimes I have understood them, and sometimes I have not. I have heard two medical experts give testimony in the same case, one of whom I understood and the other I did not understand. And I say that a knowledge of the English language is essential, as essential as a knowledge of medical terms. You must remember that Dr. Holmes once said of a lawyer that he had to half-know more things quicker than anybody else in the community; and you have got to get your lawyer, your prosecuting attorney, to half-know what you know, and be able to draw it out of you on the instant on the witness-stand; and you have got to get him into a condition of mind, by the use of ordinary, plain, Anglo-Saxon words, to understand your exact view of the case. You have got to get him into a condition where he can draw out from you what you want to present to the jury, to the twelve men, often of very limited understanding. And if I could add anything to what the Attorney-General has said, it would be to urge the right and simple use of the English language in putting in your evidence.

When you come to testify, you are so apt to qualify your judgment that you don't give your opinion, but your qualifications first. And if I should make a suggestion to you, it would be to give your judgment first, your reasons for it next, and any limitations upon your judgment last. I think the jury would understand you better if you did that.

I should like to have medical examiners remember that they are judicial officers; that they are part of the machinery of the Commonwealth to detect crime. I don't believe that, as such judicial officers, they have a right to take sides in any case whatsoever; neither do I believe that, as such judicial officers, they have any right to take the side against the Commonwealth in any case which may be presented in the Commonwealth. I believe that they ought to always keep their minds open; to learn all the facts accurately — medical and otherwise; that they ought to keep themselves in a judicial condition of mind until the case is through; that they ought to give their opinion first, their reasons next, and qualifications of that opinion last; that they ought to try to reduce everything they say to the ordinary language of human beings who are on the jury before them.

DISCUSSION.

Dr. Bronson: This gentleman says that he don't think that the medical examiner should take issue against the State. What does he mean by that?

Mr. Hoar: I mean exactly this, that I think the medical examiner is a part of the machinery of the State; and while he should keep his mind entirely open and tell the exact truth, while he should give his opinion exactly, he should never be found as an "expert" on the other side where the State is involved. I think it damages his professional standing as a witness whenever he comes forward later as a witness for the Commonwealth. I think the willingness often shown in cases to testify against the Commonwealth as an "expert" against those chosen by the Commonwealth to be medical exami-

ners, and in opposition to the view taken by them, has a tendency to degrade in the public mind the position of the medical examiner.

DR. BRONSON: I agree with my friend, the district attorney, on this subject; but there is one question involved here on which I desire to ask his advice as an ex-medical examiner. He, of course, has recently conducted a cause in the interest of the United States against a man who was alleged to have committed murder upon the high seas. Two experts were brought into that case (medical experts). One, examined by the defence, was present during that trial and was examined as to the mental status, so far as he could give it, of a certain witness in the case; and upon being brought upon the stand, he alleged that in his opinion that man was insane. The antecedent history emphasized that opinion, as I understand it. And he went into the record as a believer in the unsoundness of that man's mind. When the question was submitted to analysis, men who believed in the standing and character of that expert believed, I think, as a rule, that that witness was unsound mentally. Later, the district attorney called an expert who has charge of one of our insane asylums, and he took an adverse position. He declared his belief that that man was not insane, not unsound mentally, and that he had not been unsound at Rotterdam years before.

Now, in the case of that kind of questioning, I desire to ask the district attorney as to how he is going to harmonize views — those two statements — by any process other than that of reason? If Dr. X had been sent there by the United States, would he, in the opinion of the district attorney, have entertained views adverse to those he expressed when examined there by the defence? If so, this, of course, is a warping of that man's judgment based upon the method by which he was brought there as a medical expert.

MR. HOAR: I must decline to criticise any of the witnesses that have been in the case I have personally conducted. But I will say to my friend that I should like nothing better than to have it in the power of any court to appoint medical experts to give a definite decision, unbiased by the fact that they were called as witnesses on either side. I believe that that is essential, for the reason that the doctor states here. Men unconsciously take sides. They can't help it; I do it myself. Men do it honestly. If it were best for the court (it could not be done, in my judgment, without giving either side the entire right to call medical witnesses) in a case where opinion is given on either side, to examine men of character and unbiased, selected by the court and not by the counsel, to get their judgment, it would materially help twelve men, laymen, to decide the question at issue. And I should like to see that done.

I cannot discuss the particular matter stated here. And there is nothing, as long as our jury system exists — and I am a thorough believer in it, because I believe in my experience with judges and lawyers and doctors that the ordinary Yankee gumption of twelve men is apt to be right as much as that of twelve educated men — but to rely upon the natural sagacity to detect flaws in even medical testimony, and to "size up" men even if they are doctors.

THE IDENTIFICATION OF SEMINAL STAINS.[1]

BY W. F. WHITNEY, M.D., OF BOSTON,
Associate Member.

AT the last meeting of the Society a paper was presented by Dr. Wyatt Johnston describing a micro-chemical test for seminal stains proposed by Florence, of Lyons. It is briefly as follows: A suspected spot is soaked in distilled water for a few minutes, and to the fluid obtained is added a drop of a saturated solution of iodine in iodide of potash (iodine, 1.65; iodide of potash, 2.54; water, 30). An immediate precipitation of dark-brown rhombic crystals of iodine takes place. Their general shape and appearance very closely resemble those of the so-called hemin crystals, which are obtained from blood stains by Teichmann's test. (Fig. 1.)

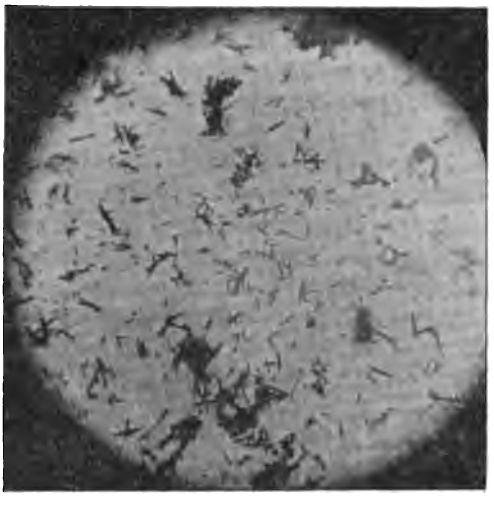


FIG. 1.

Crystals obtained by Florence's reagent, from a spot on cloth eight months old.

The reagent and material were placed in my hands for the confirmation of statements made in regard to them. I have gone carefully over the ground, and find the facts to be, in every particular, as stated.

The reaction took place readily both with the material furnished by Dr. Johnston, and that which was prepared under my own direction. The only

[1] Read before the Society, February 3, 1897.

difficulty encountered was that it was found impossible to dissolve all of the iodine according to the given formula. But after taking up as much as possible the filtrate was found to act perfectly.

Crystals were readily obtained from stains, which had been dried for a few days, several months, and two and a half years.

Stains from any other of the ordinary fluids of the body (urine, saliva, milk, fecal material), failed to give the reaction, as well as stains from leucorrheal and gonorrheal discharges.

Trials were also made from the contents of human testicles, epididymis, and seminal vesicles without any result; except in one recently excised testicle a few small crystals were thrown down by the fluid squeezed from the epididymis. The fluid from a spermatocele containing large numbers of spermatozoa was also negative. The fluid expressed from the prostate was without action, either when used alone or mixed with the secretion from the seminal vesicles. Of course, with the exception of the testicles, the material came from the autopsy table, and post-mortem changes cannot be ruled out. But the evidence from all of the available material shows that as far as man is concerned the peculiar substance which gives the reaction is formed in the mixed seminal secretion during life.

From the epididymis of a rabbit, however, an abundant precipitation of small crystals was obtained; while from that of a dog there was no result.

A preparation was made from a spleen from a case of leucemia, in which were numerous Charcot-Leyden crystals, which are regarded as identical in composition with those formed in slowly evaporated semen. The result of the test was negative.

I can throw but little additional light upon the nature of this peculiar substance; and its isolation must be left to the chemists.

But it is certain that the test will be of great value in preliminary examinations for medico-legal purposes, and one that should never be omitted in the examination of suspected spots.

As the reagent gives a precipitate with many of the alkaloids (morphine, strychnia, etc.) and their salts, its chief value is a negative one, just as is the guiacum test for blood stains. So that if a positive result is obtained the further step of demonstrating the presence of spermatozoa must be taken before it can be submitted as evidence in court. For this end, I have made a series of studies to improve the technique and so facilitate such examinations. And the following is the best method which I have found, thus far:

A small bit is cut from the cloth on which is the suspected spot, or if it is on a hard surface a little is scraped from it. This is placed on a cover-glass, wet with a drop of distilled water, in which it is carefully teazed apart with fine needles and the larger fibres removed. The drop of fluid is carefully evaporated over a flame and fixed to the surface by rapidly passing it through it three times. Upon the film thus formed, are poured a few drops of an aqueous solution of eosine, which is allowed to act for a few seconds and then washed off with distilled water. An equal amount of a strong

aqueous solution of methyl green is then poured on and gently heated over the

and the identification could be easily made.

From the above it is evident that with Florence's test and the double staining of the spermatozoa, there should be no doubt in the mind of the medical examiner of the presence or absence of semen in a suspected spot.

APPENDIX.

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SUDDEN DEATH DUE TO ALCOHOLISM.[1]

BY E. P. HURD, M.D., NEWBURYPORT, MASS.
Medical Examiner.

THE following cases illustrate the difficulties which sometimes present themselves to the medical examiner when called to diagnosticate sudden death due to alcohol poisoning from death by some other poison, as opium, or by apoplexy.

CASE I. A. B., age thirty-five years, a Swede, hired man and farm-worker, residing in Shepton, Canada, was found one evening dead by the roadside not far from his home. The body was recognized by a passer-by and removed to a barn. Being summoned, I viewed the body and the situation where it was found, and noted that there was no blood on the ground, and that there were no marks of violence on the corpse. The coronor was notified, and arrived early the next day.

The following facts were brought out at the inquest: B. was of intemperate habits, and had been for several days on a spree. On the evening of his death he had been to the neighboring village, and after taking several drinks at the hotel, he had started for home with a whiskey bottle replenished at the bar in his pocket. This was found, nearly empty, by the roadside near the place where he died.

The coronor ordered an autopsy, the details of which are as follows: A man of medium height, light complexion, rather stout and of bloated appearance. Post-mortem rigidity very pronounced. Large ecchymoses on dependent parts (hypostatic congestion), great turgidity and purple aspect of face and lips, a frothy sanguinolent fluid escaping from mouth. Stomach exhibited a patchy inflammation and some ecchymoses; contained half a pint of a sour, sanguinolent liquid smelling of whiskey. Diffuse redness of the mucous membrane of the small intestines. Liver and spleen congested, the spleen softened. Heart and kidneys normal. Lungs edematous; mucosa of bronchi injected.

Cerebral meninges congested; sinuses turgid; venous network of pia distended; punctiform hemorrhages on surface of cortex in both hemispheres. No apoplectic effusion in centrum ovale or in ventricles.

The fact of alcoholism was proved by the autopsy, for these lesions were undoubtedly due to alcohol. The coroner's jury, therefore, brought in a verdict of sudden death due to alcohol poisoning. Query: Why did A. B., a robust man, with sound heart and no disease of viscera incompatible with a much longer existence, come to his death so suddenly? It was said that he

[1] Read at the Annual Meeting of the Society, June 8, 1897.

had often withstood more liquor than he had imbibed in this drunken debauch. This was in the month of October, and the deceased was thinly clad, with summer suit and no overcoat. May the chilliness of the season have had something to do with this sudden death? It is known that alcohol retards processes by which animal heat is produced, hindering the transformations of oxyhemoglobin in the blood, and inebriates poorly resist a severe chill. It has been proved that blood cooled below a certain point has a paralyzing influence on the nerve centres, including the cardiac and respiratory centres in the bulbus.

Case II. D. F., aged seventy-five years, farmer, of good early antecedents, had for several years been an inebriate. When I called, on the evening of March 16, 1868, to see him, I found him in bed, in deep coma, with heavy, stertorous breathing, bloated, livid countenance, feeble, flickering pulse — in fact, nearly dead. There was a perceptible alcoholic odor in the breath. That afternoon, as appeared from the testimony of one of his family, D. F. had drunk heavily. It was said that he had lived on whiskey, as, owing to a bad stomach, he had been unable to take food. The autopsy, performed next day, showed a stomach thickened and inflamed, with hemorrhagic extravasations and erosions of the mucous membrane. About four ounces of thick mucus was removed from the stomach, and somewhat less of a prune-juice liquid redolent of alcohol. A cirrhotic liver with sclerotic changes not advanced and a fatty heart were also found. The membranes of the brain were thickened and hyperemic, and there was a large subdural clot on the left side covering a large part of that hemisphere. The ventricles were distended with blood and serum, and there was some edema of the convolutions of the right hemisphere. This case was entered as sudden death by apoplexy of which the exciting cause was alcohol.

As physicians and as medical examiners, we are continually meeting instances where the diagnosis of the coma lies between apoplexy, narcotic poisoning, and alcohol poisoning — that condition of the latter where the person is supposed to be dead drunk. In former days when bleeding was in vogue, I have known a person to be bled for apoplexy who was simply dead drunk, and who recovered completely after several hours. I have also known patients to be regarded as dead drunk who were in the coma of apoplexy. As Watson says: "Coma is coma, from whatever cause, and you must seek to ascertain the cause in the history and other circumstances of the case. You inquire whether he is known to have been drinking; you try if you can perceive the odor of wine or brandy in his breath; you endeavor to make out whether he has been low-spirited or in known difficulties; in short, whether it is likely that he may have swallowed poison. But from the symptoms and actual condition of the sensorial and motor functions you cannot solve the question."

The two cases above reported occurred many years ago, and no chemical analysis was made of the contents of the stomachs; it was, however, sufficiently apparent from the odor and from other circumstances that the liquid found in the stomach was impregnated with alcohol.

The following case of sudden death in an inebriate was undoubtedly due remotely to alcohol.

Case III. F. F., a Norwegian, silversmith, aged forty years, was admitted to the Houston Institute, Newburyport, July 4, 1893. He came of a healthy, long-lived family, and had never been sick prior to entering the institute. He had been a hard drinker for twelve years — daily drams, frequent sprees. He had been also an inveterate smoker. The physician at the institute had noticed a weak, intermittent pulse and diagnosticated a "tobacco heart." He was placed under the usual treatment for inebriety, tobacco and alcohol being soon completely withdrawn.

August 7th he left the institute "cured" but with more or less pain and discomfort in precordial region with shortness of breath, and complete inability for exertion; he could no longer work at his trade. The night of the 17th of August he was unable to sleep on account of severe stabbing, burning pain in heart, general restlessness and distress. In the morning, he walked to the institute (a short distance) for relief, became rapidly worse, was taken to his home, and died on the way.

On requisition of the mayor, I performed an autopsy on the afternoon of the 18th. Death appeared to be due to fatty disease of the heart muscle, unaccompanied by any fibrosis or occlusion of the coronaries. The accumulation of fat exterior to the sarcolemma was phenomenal, considering that adipose development elsewhere was not up to the normal in a spare, anemic subject; the interfascicular connective tissue was infiltrated with fat in the form of yellowish streaks and deposits crowding and compressing the muscular fibres, which presented a yellowish or fawn color; the heart walls were soft and flabby, and the myocardium in places could be easily torn through or broken down by pressure of the finger. The whole of the left ventricle seemed enveloped in a fatty layer under the visceral pericardium, thinning out and disappearing toward the apex; the coronary arteries, though normal in appearance, were buried in adipose substance in the first part of their course. A section through the middle of the left ventricular wall showed the myocardium interpenetrated by and stuffed with adipose matter. The solid organs of the abdomen were congested and more or less altered. The spleen was enlarged and softened; its pulp of the consistence of *bouillie*. The liver was enormously swollen, firm and hard, cutting with great resistance. The kidneys were enlarged and hyperemic, blood flowing freely on section. Stomach empty and normal in size; no thickening of walls and only a little patchy redness of mucosa about greater curvature. I returned this death as the result of fatty disease of the heart and other lesions, probably due to chronic poisoning by alcohol.

After much reflection on this case and careful study of my notes made at the time, I am convinced that this was a true case of what the French writers call *surcharge graisseuse* — first, fatty increase, second, fatty transformation. It was not primarily fatty degeneration or parenchymatous myocarditis. Doubtless other factors besides alcohol were operative here to, so to speak,

submerge this heart by adipose. When this man went to the institute he was comparatively well, able to work, though under the dominance of his evil habits. In one month's time the organ most essential to the sustenance and nutrition of the whole economy was hopelessly smitten in its vitality.

Interesting questions present themselves here; but they are all unsolvable. How far were the lesions in this case due to alcohol, and what part, if any, had tobacco in their causation? What is the explanation of this etiological rôle (now acknowledged by the best pathologists) of alcohol in the production of cardiac lipomatosis and steatosis? How far, if at all, were the morbid changes described in this case, and especially the cardiac steatosis, due to suppression of the stimulus of alcohol and tobacco; in other words, did abstinence precipitate the fatal issue?

APPEARANCES OF THE ALIMENTARY CANAL IN SUDDEN DEATH BY ALCOHOLISM.

The effect of alcohol on the digestive tube varies with the dose, the quality and the degree of dilution. That this organ is in some instances very tolerant, long preserving its structure and function unimpaired despite great excesses, is a fact, notwithstanding the asseverations of certain of our school text-books. That the abuse of any alcoholic stimulant does eventually entail inflammatory changes in the alimentary canal is certain. Dujardin-Beaumetz and Andigé, in their experiments on acute and chronic alcoholic poisoning, in animals (principally hogs), found that toxic doses inflame the stomach and intestines even when injected under the skin. Of all the alcohols, ethylic is the least baneful, eight grammes per kilogramme of the animal's weight being a fatal dose. Amyl alcohol (fusel oil) is much more baneful, a dose equal to two grammes per kilogramme being speedily fatal. The effects of ethyl alcohol (spirits of wine) on the stomach are much less pronounced than those of propyl, butyl and methyl alcohol; the latter violently congest and irritate the stomach, causing hemorrhages and obstinate vomiting. The practical lesson is that impure alcohols, such as new rum, and whiskey that has not ripened in casks, and are impregnated with fusel oil (the bane of new liquors), and all such spirits as are fraudulently sophisticated with fusel oil, are much more deleterious than wine and spirits containing only ethyl alcohol, produce more intense inflammatory changes in the digestive tube, and are more likely to be followed by sudden death, generally in coma and sometimes in convulsions.

There are no constant appearances of the stomach and other viscera in alcohol poisoning. In other words, the lesions give no absolutely infallible criteria. There may be uniform redness or there may be redness in patches; there may be petechiæ and ecchymoses of the mucous membrane and punctiform hemorrhages into the gastric cavity, or there may be large extravasations of blood and hemorrhagic erosions, the stomach may be of normal thinness and but slightly injected, or it may be thick and rugous, intensely red in places and black and sloughy in others; and the abdominal viscera may be hard or soft,

hypertrophied or shrunken, and yet the death shall have been caused by alcohol poisoning.

It cannot be too much borne in mind that alcohol has a special affinity for the nervous system; or we might say that the nervous system has a sort of chemotoxic affinity for alcohol. In some inebriates the nervous phenomena of alcoholism are far the most marked and the visceral lesions are inconspicuous; even the entire absence of such lesions in a given case would not warrant the affirmation that the sudden death was not due to alcohol. Nor would the failure to obtain a history that the deceased person had prior to death passed through the classic phases of drunkenness (excitement, then perversion, then depression of the faculties and forces) warrant the conclusion that the individual did not die from alcoholism.

"In some cases," says Boehm, "the effects of alcohol are diametrically opposite [that is, from excitement], having a depressing effect from the very first; and the person goes on to a state of narcotism without any of the ordinary outward signs of drunkenness. The amount of consciousness and rationality retained by the drunken man varies greatly, and is by no means always proportioned to the quantity of poison imbibed. Men who are manifestly drunk often act and transact business for a time with complete reflective faculties, and with a good deal of consideration. Death may occur early in the first stage of drunkenness in consequence of asphyxia and paresis of the heart, but it may occur in the later stages." [2]

These observations will serve as an introduction to my fourth case.

Case IV. E. J. C. died suddenly at Grape Island, in Plum Island River, between Newburyport and Ipswich, on the afternoon of August 6, 1896. This woman, considerably under the middle age, strong and robust and of fine physique, was left at the hotel in the afternoon of the date mentioned by her companion, a gentleman from Rowley, in a state of intoxication. The two persons had come down from Rowley in a boat together, and C. had taken copious draughts of whiskey on the way. M., the male companion, stated that he had left C. at the hotel because she was drunk, and he did not know what else to do with her. From an examination of all the evidence, I am inclined to take M.'s statement as the truth. There was, at the same time, the testimony of two parties at the hotel that C. when she entered the hotel did not walk, act or speak like a person actually drunk, nor was any smell of liquor noticed in the breath. There was evidence that the woman took some liquor (furnished by M. from the bar) after arriving at the hotel. M. returned to Rowley in his boat. Shortly afterwards, Mrs. C. rose from her chair, walked across the room, then fell heavily on the floor, and instantly died.

I was summoned by the police from Newburyport, this place being accessible by a straight road over the sand meadows. Dr. Clark, medical examiner of Ipswich, was also summoned, and we both arrived at Grape Island at nearly the same time, my arrival antedating that of Dr. Clark. It was agreed by us to remove the body to Newburyport for an autopsy. The autopsy was held

[2] Quoted from Ziemssen's Cyclopedia, vol. xvii, p. 393, Am. ed.

in the afternoon of August 7th. To confine myself to essentials, I may state that we found in the viscera of the abdomen and in the encephalon lesions which could properly be ascribed to chronic alcoholism. The stomach and small intestines were intensely hyperemic, as manifested by a diffuse redness of the mucous membrane and extreme vascular dilatation; there was nothing there to indicate chronic lesion. The liver and spleen were enlarged and softened; the kidneys were very hyperemic, large and soft; blood freely oozed on section. There was some congestion and edema of the lungs and bronchi (perhaps altogether hypostatic). In the encephalon was found an old pachymeningitis existing as a limited lesion along the longitudinal fissure. There was an ecchymosed spot as large as a silver dollar back of the right ear and a corresponding spot within the cranium, and extending to the dura mater, but no free blood; this was evidently produced by the fall, being the part that struck the floor. It was judged that a fall producing a lesion of this kind in a rather stout and heavy woman might cause considerable cerebral concussion. The meninges were unduly vascular and the sinuses were engorged, but there was no hemorrhage. The heart was normal; the ventricles were empty. Death evidently occurred in systole.

There was found in the stomach a small quantity (about half a pint) of a turbid, somewhat bloody, fluid; this was collected in a bottle and along with the stomach sent to Professor Hills, of Harvard Medical School. In another bottle was sent the urine drawn from the bladder, and in a third, portions of the liver, the spleen and the kidneys. The general public manifested great interest in this case, and there was a wide belief that this woman had died from some poison other than alcohol.

Professor Hills in his report stated that he failed to find any toxic agent excepting alcohol. The presence of that spirit was detected in the stomach, in the urine, and in the other organs. Professor Hills gave as his opinion that the woman died of alcoholism. My own theory was that the fall on the head was an important factor, giving a powerful adjuvant influence to a paralyzing noxa already existing. If this be not so, I fail altogether to understand the suddenness of this death, and can only suggest that now and then alcohol may act as chloroform in rare instances acts — by paralyzing the medulla oblongata before the upper brain is completely subjected to the influence of the poison.[3]

[3] I add in a footnote that this is the case where the Board of Health of Ipswich, thinking their rights interfered with by the removal of this body to Newburyport (that is, from one town to an adjoining town) without their permission, and believing that the law defining the functions of boards of health gives such boards authority over medical examiners in such cases, who must apply to these boards for consent before they can legally remove bodies out of one town into another — this board, I say, appealed to Justice Sayward, of Ipswich, who sustained the view of the board, and fined the undertaker who took the body from Grape Island to Newburyport ten dollars and costs. An appeal was made to the Superior Court, and the case was *nolle prossed* by District-Attorney White, so that, according to this judgment, medical examiners are not amenable to boards of health in the discharge of their duties within the limits of their districts.

A GUNSHOT WOUND OF THE HEAD.[1]

BY WILLIAM D. SWAN, M.D., CAMBRIDGE,
Medical Examiner.

No class of injuries has received more attention of late years, from a scientific and surgical point of view, than gunshot wounds. Also, with a view to determine the destructive force of new missiles, a vast number of these injuries have been carefully examined, and innumerable experiments have been made on dead bodies and every conceivable kind of material, and results carefully noted. Results of such work are of great value in the examination of wounds, and the determination of instruments and conditions under which they were inflicted. I have been unable to find a case parallel to the following; and while it may not be unique in the history of gunshot wounds, it at least is unusual and interesting from a medico-legal point of view.

The body of a man was found in the woods of Arlington, June 19, 1892. The body lay on the back, arms at the sides. There was a pool of blood beneath and around the head. A pistol lay on the belly. There was no disorder of the clothing or other evidence of a struggle. Rigor mortis was present. No odor of decomposition. Some fresh fly-blows about the head. The pistol was a revolver of cheap pattern, .38-calibre, short barrel. The chambers contained one empty cartridge and one loaded one showing impress of the hammer on its rim. There was *not* a small round hole in the right side of the head, with blackened edges and surrounded by powder marks. There *was* a large, irregular-shaped scalp wound in the top of the head, which presented none of the ordinary characteristics of a pistol wound. There was no blood or injury in the mouth or nostrils. There were no means of identification.

An autopsy was held the following morning in the presence of Medical Examiner Durell, of Somerville, and Chief Meade of Arlington, probably thirty-six to forty-eight hours after death.

Body of a man upwards of fifty years of age — lean, long-armed, muscular and well formed. Over coronal suture in the median line a star-shaped, or roughly cross-shaped wound of the scalp, with gaping edges, two inches by one and three-quarters inches in extent. Skin and hair at the edges not burned or blackened. Beneath this wound an irregularly round hole in the skull, three-fourths of an inch in diameter at outer table, and much larger at the inner table. Surface of the skull and periosteum and inner side of scalp about this hole black, and covered with grains of powder and some minute scraps of lead. Fronto-parietal suture on the right side separated one-sixth of an inch; on the left side a fracture of the parietal from the bullet hole almost to auditory

[1] Read before the Society, June 8, 1897.

canal, and thence to left orbit, edges of parietal lobe separated one-sixth of an inch and the inferior edge of the parietal elevated and separated one-quarter of an inch from the temporal. Brain much lacerated in a vertical direction beneath the hole in the vertex, and blood extravasated. At a depth of three inches at the base of the brain were found several pieces of bone and a .38-calibre bullet of which the forward part was flattened and bright and the edges thin and turned back. Considerable blood in the left lateral ventricle. Above the right eye and along the edge of orbital part of the frontal and the lesser wing of the sphenoid bones the brain adherent by thickened membranes. Considerable cicatricial tissue at this point and old loss of brain substance. Neighboring tissues yellowish. At the tip of the lesser wing of the sphenoid bone and inside the skull, covered with fibrous extension of the dura-mater, is part of a bullet of smaller calibre than .38, of uniform dull lead color. Skull external to this shows evidence of an old fracture, and a small piece of lead is embedded in the bone exteriorly. An old, indistinct, small, round cicatrix found in the skin two inches above and about the same distance anterior to the external auditory canal on right temple. Examination of the organs of chest and abdomen showed nothing of importance. The stomach and intestines were nearly empty. There were no powder-marks on the hands.

The man was fully identified from the photograph, and it was learned that he had attempted suicide by shooting himself in the right temple about three years previous. The fact of suicide being established, it remains only to consider the peculiar aspect of the wound.

The explosive effect of a bullet wound is due to lateral expansion in solid substances and to hydrostatic pressure in fluid or semi-fluid matter. The lateral expansion causes fissuring of a bone, for instance, and as a general rule the greater the index of cohesion the more extensive is the splintering or fissuring speed of the missile. Here is an uncertain element, for the element of elasticity sometimes makes the injuries less extensive with a high speed than with a low. In addition to this expansive effect, causing a long fissure on each side of the bullet wound in the skull, is the hydrostatic result of rapid compression of the semi-fluid brain mass confined in the cranium. The molecules of a liquid are readily displaced, and a greater effect will be produced on them by a relatively lower velocity, but with high velocity it is enormous. A rifle bullet will pass through an empty tin can, making two round holes; but if the same can be filled with water, it will be burst and torn to pieces by the impact of the bullet on the water. The base of the skull escapes injury because the dome is already split by the expansive effect of direct impact.

The last and most unusual cause is the direct expansive effect of the powder gases, as shown especially in the splitting of the scalp and the deposit of powder residuum on the inside of the scalp and the separation of the scalp from the bone.

It seems probable that the man, in his second attempt at suicide, chose the top of his head as a more vulnerable spot than his temple, where he had been unsuccessful before. He sat down in a secluded spot, bent his head forward

and holding the pistol in both hands, perhaps with a thumb on the trigger, and with the muzzle to the top of his head, fired; the hammer clicked on the cartridge and there was no explosion. With nervous haste and desperation he recocked the pistol and pressing the muzzle firmly against his head, again pressed the trigger and this time with the desired results. As he fell back dead, his hands fell at his sides, depositing the pistol on his abdomen.

There is a case reported by Ogston of a man who fired a pistol with the muzzle pressed against his breast, with the result that the pistol was blown away and he received only a slight contusion of the skin of the breast. I cannot believe that that is a result to be depended upon.

An important point in determining whether a pistol wound is self-inflicted is the presence of powder smut on the hands. I have lately seen a case of suicide by shooting in the right side of the head, in which the fingers and palm of the left hand were blackened by powder. This bullet wound in the right side of the head was much bruised and blackened. This individual must have steadied the muzzle of the pistol with his left hand.

THE PRESERVATION OF SPECIMENS WITH THEIR NATURAL COLORS BY KAISERLING'S METHOD.[1]

BY WILLIAM F. WHITNEY, M.D., BOSTON,
Associate Member.

THE necessity for preserving anatomical specimens with their natural colors has always been felt, and the impossibility of retaining the delicate shades which are indicative of many of the morbid processes has always been a great bar to proper teaching of pathology. With the introduction of formaline as a hardening agent and the modifications in its use recently published by Kaiserling,[2] it seems as if the collections of the future would be able to present something for the student besides variations in shape and size and fractures; for this is all that can be readily seen by him now, and his imagination has to supply the rest.

But it is not only for the instructors, but also for the medical examiner, that this promises to be of advantage; for the soft parts of the body that have been injured can be preserved in this way and shown in court, if necessary, and would often convey much more meaning to the average jury than lengthy technical descriptions.

The method is simple; the only precaution to be observed is not to put too large pieces in the preserving fluid, and to be careful to change them at the proper time. As some shrinkage is inevitable, cavities should be distended with absorbent cotton, which, of course, is to be removed when the specimens are changed. Moreover, freshness of the material adds greatly to its chance of good preservation, and soaking in water (whereby the blood coloring matter is diluted) is to be avoided.

Sections should be made with a sharp knife, and the blood which may have been smeared over the surface removed by pressing (not rubbing) a dry, clean cloth upon it. They are then to be submerged entirely in the fluid, best with a layer of absorbent cotton over them. In this manner, portions of the skin showing stab or bullet wounds, or even extensive ecchymosis, could be preserved, a little cotton being inserted to keep the edges of the wound apart.

The preservation of entire large organs is hardly practicable, as careful injection of the vessels is necessary, much of which should be done before their removal from the body.

Bile pigment will diffuse, and therefore the liver and jaundiced organs are the least fitted for this method.

As regards the length of time they will stand, it depends upon how fresh the substances are, and how carefully they are guarded from a bright light. They

[1] Read before the Society, June 8, 1897.
[2] C. Kaiserling: Virchow's Archiv, Bd. 147, s. 389.

have stood the test of a year already, and it would be hardly necessary in any legal case to preserve a specimen longer than that.

The following is the method, and the specimens which are shown with this will enable the members to judge for themselves how successful it has been in my hands:

Slices of organs, from three to five centimetres thick, are placed from three to five days in —

Formaline	200 c. c.
Water	1000 c. c.
Nitrate of potash	15 gm.
Acetate of potash	30 gm.

They are then removed, the fluid allowed to drain off and the specimens are placed in —

Alcohol 80 per cent. for six hours, then
Alcohol 95 per cent. for two hours.

From this directly into —

Water	2000
Acetate of potash	200
Glycerine	400

for permanent preservation in a dark place.

THE HOMICIDE OF MRS. HATTIE E. McCLOUD.[1]

REPORTED BY F. J. CANEDY, M.D., SHELBURNE FALLS, MASS.,
Medical Examiner.

THE ninth day of January, 1897, was like one of the rare and balmy days of October; and as the sun rose from behind the eastern range of hills at Shelburne Falls and flooded the valley of the Deerfield with light and warmth, the somewhat sharp frost of the previous night was soon dissipated; and so clear was the sky and soft the air that there was nothing to remind us that we were at midwinter, unless it was the leafless branches of the trees and the brown of the landscape.

Most of the twenty-five hundred inhabitants of the pleasant village of Shelburne Falls, so picturesquely located among the hills on both sides of the Deerfield river, had been for some hours at work in factory or store, or about their business of the streets, when a messenger came hurrying down from the hillside above the town for the medical examiner, with the information that Mrs. Hattie E. McCloud, an educated and refined lady, daughter of County Commissioner Geo. D. Crittenden, was lying dead in the woods a half-mile out of the village.

It was at about half-past nine in the forenoon that I entered the wooded slope where the body lay surrounded by some twelve or fifteen men, among whom was the father of the dead woman. Her father, coming forward to meet me, stated that his daughter had left home on the previous afternoon at about four o'clock to do some errands in the village, and when she did not return in the early evening, as expected, it was supposed by her family that for some cause she had decided to stay over night with her married sister living in town, and that for this reason no great anxiety was felt for her absence and no search made. He also said that she was subject to fainting-turns, and had probably slid down into this place in one of these spells and died from exposure to the cold, and that he didn't think there had been foul play in the case.

Mrs. McCloud was lying on her back seventy feet below the road on sloping ground with her feet down the hill, the point where she lay being connected by a path with the road leading from the village to her home. She was dressed in the usual winter clothes worn by a lady in her position, the outside garment being a loose cape with a fur collar fastened at the neck by a button. There was little disarrangement of her clothing; and her legs were extended, somewhat separated, and covered with her skirts to the knees. Observing the livid color of her face, with froth about the lips, I unbuttoned and turned down the collar of the cape, which revealed discoloration marks with skin

[1] Read before the Society, October 6, 1897.

abrasions over the larynx and upper portion of the trachea. On raising the skirts I found she had on open knit drawers, which were blood-stained about the genitals. Calling the attention of Mr. Crittenden to the marks upon her throat, I told him there was reason to suspect that her death had been by violence, and that the body and all circumstances connected with her death would have to be subjected to a careful investigation. After noting as carefully as possible the position and condition of the body as found, and ground and objects about, I had it placed on a horse blanket brought from my carriage, and carried by the hands of six men an eighth of a mile up the hill to her home. Before leaving the locality I requested the people to leave the ground, and stationed a man near by in the road to see that no one went upon the spot. I then followed the body to the house, had it laid upon a lounge in a cold room, with none of the clothing disturbed, and returned to the village to telephone District-Attorney Hammond, at Northampton, for an order for an autopsy and an officer. At 11.30, State Detective Benson Munyan arrived, bringing the order for the autopsy, which, assisted by Dr. F. H. Zabriskie, of Greenfield, I proceeded to make at half-past one o'clock in the afternoon.

The description of the autopsy is best given in my report to District-Attorney Hammond, which I will read from this point:

"To the District Attorney of the Franklin District: You are hereby notified that on the ninth day of January, in the year one thousand eight hundred and ninety-seven, at nine o'clock A. M., I received notice that there had been found lying within the said district the dead body of a woman, who was supposed to have come to her death by violence; and upon receiving said notice, I forthwith took charge of said dead body, which I found lying on its back in the woods seventy feet from the road leading from the village of Shelburne Falls over Crittenden Hill, and about one-fourth of a mile from any dwelling.

"I identified the body as that of Mrs. Hattie E. McCloud. External appearances were as follows: Hair, tangled and filled with broken leaves, was drawn out loose above her head. Hat off, lying on the ground in good order about five or six feet above her head, toward the road. Outside garment a cape, buttoned around the neck. Hands dressed in black yarn gloves, clenched tightly by her sides. Feet dressed in cloth shoes, with rubber overshoes, and legs covered by her skirts to the knees. The face and lips were livid, with froth about the mouth. Eyes closed, mouth closed. On raising her skirts considerable whole and broken leaf matter was found adhering to the open knit drawers. The hands, face, feet and other external parts of the body were frozen. Red marks on front of throat, with abrasions of the skin over the larynx, upper part of the windpipe and under side of the chin.

"I ordered the body removed to the house of her father, George D. Crittenden, where an autopsy was made by myself, assisted by Dr. F. H. Zabriskie, at about two o'clock A. M., January 9, 1897, and witnessed by Benson Munyan, Edwin Baker, Wilfred Ball and William Johnson (undertaker). Wilfred Ball acted as clerk, and took notes at my dictation. Inspection of the body showed a livid face, ecchymosis of the lips and eyelids, dried frothy

matter about the lips, abrasions and red marks about the front of the neck over the larynx and windpipe, with prints of a thumb and three fingers clearly outlined. The hair was tangled and filled with dry forest leaves. Clothing not torn or disarranged. Her open knit drawers were stained with blood at the opening, and sticking to the drawers about the thighs and legs, also in the hair of the genitals, were found dry forest leaves, most of them more or less broken up. The lips of the vulva were swollen and gaping, and dark blood was oozing from an abrasion at the entrance of the vaginal canal.

"On dissection of the neck the superficial veins were found much distended with dark fluid blood. The muscular tissue about the larynx and upper portion of the windpipe was stained with blood from capillary bleeding; the proper relations of the cartilages of the left side of the larynx disturbed, and the second and third rings of the windpipe broken in front. The lungs were filled with dark venous blood. The cavities of the right side of the heart were also filled with dark fluid blood, but the left auricle and ventricle were empty, and the organ and its vessels apparently healthy. The uterus and ovaries were normal. She was not menstruating. The blood-vessels of the brain were distended with dark venous blood; otherwise the brain was healthy.

"Matter stained with blood was removed by a teaspoon from different parts of the vaginal tract, and taken to Greenfield by Dr. Zabriskie for microscopical examination. The examination was made by Dr. Zabriskie, assisted by Mr. Frank B. Wells, an expert microscopist, with the following result: Semen with spermatozoa was found in the specimen taken from the upper part of the vagina, also much vaginal cell matter, a part of a leaf, and several bits of hair — the latter being found in the specimens taken from the lower portion of the vagina.

"Mrs. McCloud was thirty-seven years of age; had been a widow six years; was well nourished and strong; of medium height, and weighed 145 pounds.

"My examination shows clearly that Mrs. McCloud died from strangulation by means of a hand upon her throat, and that sexual connection with her had taken place at or near the time of death."

This was dated at Shelburne Falls, January 12, 1897.

John O'Neil, Jr., a man twenty-eight years old, almost always out of work, and of gross habits of intemperance, very soon attracted notice and excited suspicion by his behavior — more especially by the free use of money in the saloons, which he was known not to have possessed before the evening of the homicide. He was arrested on the charge of murder January 12th, and the government at once set to work to make out their case against him on what proved to be wholly circumstantial evidence, which was only successful through the most able and carefully prepared work of the district attorney and those whom he called to his assistance.

Evidently the first hope of the defence was to show that the woman's death was not by violence, but that the cause and manner thereof were different from that claimed by the prosecution, or at least to throw doubts upon this claim; and to this purpose both the medical examiner and his assistant, Dr.

Zabriskie, were subjected to a long and severe process of cross-examination. The government, by request of counsel for the defence, secured for them the services of Dr. Woodbridge, Professor of Anatomy and Physiology in Williams College, and a very able and successful practitioner of medicine at Williamstown; and it was under his advice and instructions that the cross-examinations were conducted at the trial.

Every step of our work was closely followed, and the order in which it was done, and every means possible put forth to weaken the force of the conclusions we had reached, both from gross appearances as well as from the microscopical examination.

On the third day the defence came into court, admitting the government's claim that a homicide and rape had been committed, and Professor Woodbridge went home. The trial lasted eight days; and though the prisoner was never located within an eighth of a mile of the spot where the body was found, and not any direct and positive evidence was offered, yet the jury brought in a verdict of murder in the first degree within an hour after being charged by the judge.

CONTRE-COUP; ITS RELATION TO INJURIES OF THE HEAD.[1]

BY B. H. HARTWELL, M.D., AYER, MASS.,
Medical Examiner.

MUCH has been said by the older writers about injury to the skull by contre-coup, but it is probable that the skull is seldom fractured by force applied from the opposite side of the head, except those cases of fracture of the base from blows upon the vertex, and a large proportion of these are from radiation and not contre-coup. Aran found only four of the latter out of sixty, in which the base of the skull had been fractured, the others having radiated from the site of the blow. Charles Phelps states that 60 per cent. of severe injuries of the head involve fracture at the base, and a large majority of these are continuous with fissures extending from the vertex. The character and extent of these injuries is so influenced by the nature of the blow, its rapidity, the instrument used, the position of the body and head, the variation in the density and thickness of the bone in different individuals that no rule can be formulated as to the amount of injury done by a given blow. Injuries to the brain from contre-coup are much more frequent, and it is desired to direct attention to lesions that are opposite to or more or less remote from the force applied, and which may appear minor in degree when only said force or the character of the injury is considered.

It is not infrequent that cases come under the notice of the Medical Examiner in which the local lesion is small in comparison to the brain injury and in the absence of cerebral symptoms have been treated by the medical attendant as simple contusion, or have received no treatment at all. These cases are of a good deal of interest to all medical observers, and in their medico-legal bearing are of great importance to us. They furnish additional proof that the answer to the question, "What cases shall be viewed by the Medical Examiner?" should be, "All cases where violence enters as a factor in the cause of death." By violence here is meant force from without, whether or not it appears plain at the time that it was at the hands of some person or persons. It is not difficult to understand how a blow upon a thickened portion of the skull in being disseminated over the head should fracture the bone on the opposite side, where the resistance is less, as in the case of our martyred President Lincoln, where the bullet entered the occipital bone and fractured the orbital of the opposite side, or in cases of fracture of the base of the skull from a blow upon the top of the head. But that a blow upon one part of the head should injure the brain at or near the opposite side without injury to the skull, either at the site of the blow or the brain lesion, is not so

[1] Read before the Society, October 6, 1897.

readily understood. Duret interprets these lesions by a certain elasticity of the cranial vault, and the pressure in the brain of the cerebro-spinal fluid, and has shown that the wave in this fluid created by a blow produces what is often its maximum effect on the opposite side of the head, tearing vessels of the pia and cortex.

We have abundant proof that the skull has a certain amount of elasticity. We know that the cerebro-spinal fluid extends from the lymph sheaths of the small cerebral arterioles into the spaces between the convolutions, thence into the large sacs, the largest four being near the fissures of Sylvius, at the base of the brain, the inferior portion of the spinal cord and below the cerebellum, this latter connecting through the foramen of Magendie with the fourth ventricle, thence by the iter e tertio ad quartum ventriculum with the third and lateral ventricles. These anatomical points are necessary that we may understand the phenomena of concussion and explain disseminated cerebral contusion.

The following cases, briefly stated, will serve to illustrate:

C., colored, age thirty, large frame, well developed and muscular, was at work in a brick building when a brick fell and struck the top of his head to the left of the median line. He paid no attention to it at the time except to notice some dizziness and soreness at point of injury. There was contusion of the scalp, but no bleeding or separation of the parts. He continued to do some light work, but complained of headache and a feeling of easy fatigue. Four months afterwards he was found dead in bed, not having been seen for two days. He lived alone and had no medical attendant. There were no marks of violence upon the body. A slight scar was found at the point of the blow, but no injury of either external or internal tables of the skull. In the middle lobe of the brain, right side, about one-half inch from the base of the skull, was a spot of softening the size of an almond. It was of a soft creamy consistency and around it the brain substance was yellow in color. The rest of the brain was in a healthy condition and the other organs of the body showed no evidence of disease.

C. P., age sixty, was thrown violently upon the sidewalk by a large dog running in the opposite direction. He struck the outer portion of the left orbital ridge on the ice, cutting through the skin and causing a good deal of swelling and discoloration. He did not consult a physician. When seen four months afterwards, he gave a history of continuous pain from the time of the accident back of the right ear, though he had been attending to his usual duties. Temperature 101°, pulse 70, labored. He was put to bed and the unfavorable nature of the case explained. The rise of temperature continued for two weeks. Meanwhile almost complete paralysis of the left side developed, with delirium and stupor. Gradual improvement took place, and at the end of six months recovery was complete.

W. B., age fifty-three, was sitting in a chair in the rear car of a freight train, when the car was suddenly stopped by the setting of the brakes. He was tipped back, striking his head against a portion of the car. He got up,

complained of pain in his head, became unconscious and died in eight hours. There was no bruise or mark upon the head, nor was the skull injured. Autopsy showed that the pons varolii had been torn, and in the softened places were small clots of black blood.

S., age twenty-eight, was struck on the left side of the head two inches from the median line. He lived forty hours. There was a stellate fracture extending to the base of the skull, but no depression of the bone. In the middle lobe of the brain, right side, under the pia mater, was a brown spot, size of a peanut, composed of broken-down brain tissue and blood from injured vessels. There was no fracture of the bone on right side, nor injury of the brain except at this spot.

Contre-coup is a factor in the causation of death in certain cases and is to be taken into consideration in all injuries of the head; and outside of medico-legal questions, if an operation is to be performed, the side to be opened is to be determined by cerebral localization rather than by external evidence of injury. The first two cases show that results may not come upon receipt of the blow, and, although they were purely accidental, might easily have been homicidal. The third case, from the absence of all external evidences of injury, the character of the blow, the manner of death, the short time that elapsed after the fall, the increasing coma and absence of reflexes might readily have been mistaken for apoplexy. In the fourth case, though the disorganization of a small portion of the brain had nothing to do with the death, it is still interesting from the fact that had the fracture not radiated to the base of the skull, death might not have resulted for some time, and the blow as a cause might have been overlooked.

A CASE OF CARBOLIC-ACID POISONING.[1]

BY FRANK HOLYOKE, M.D., HOLYOKE,
Medical Examiner.

At four o'clock P. M. on January 9th, Alfred S., an Englishman, fifty-three years of age, died suddenly in Holyoke at his sister's home, before medical aid could reach him. He had been a heavy drinker of alcoholic stimulants for many years; but the sister and others in the house were certain that he had not had any alcoholic drink for two days and had not taken food for twenty-four hours.

At six o'clock, two hours after the man's death, I viewed the body, which was found lying in his underflannels obliquely across the bed on his back. The head lay towards the foot of the bed. The bed-clothes (in disorder) were soaked with urine. The pillow, which had been placed under his head by his sister about twenty-five minutes before death, was wet with sweat where his face had lain. There was no sign of vomiting.

An empty two-ounce bottle labelled "Pure Carbolic Acid," I found under his pillow at the head of the bed. The bottle was corked. There was no trace of any carbolic acid on the outside of the bottle beyond its lip. It had been bought at a local drug store and the sale properly registered as sold January 3d to Alfred S. "for a wash."

His sister's child, sixteen years of age, was seated with a playmate in the room next to his bedroom. She heard him swear loudly and then begin to moan; and she called her mother's attention to her uncle's moaning, which lasted possibly for three minutes before she gave the alarm. Her mother rushed in and found him lying as described, and heard him shouting loudly "How goes it?" but he was unconscious. He died about twenty-five minutes after she entered the room, during which time he appeared to be unconscious, no twitching or convulsive movement, or respirative sighing being observed. The eyes, she said, were staring and glassy.

The body was that of a well-developed man of large, powerful frame, six feet tall, weighing about one hundred and seventy pounds. The skin-surface, except for some light-colored, hypostatic spots over the back, had a very pale, yellowish, waxy appearance, having a moist, clammy feel and non-elastic. The belly was flat. No rigor mortis had developed. The mouth and eyes were closed; the pupils were moderately contracted. The expression of the countenance was composed.

The mucous membrane of the mouth, tongue and inside of the lips was of an opalescent whiteness. I could detect no odor of carbolic acid upon the fingers, nor from the body, nor from the mouth, though its odor in the

[1] Read before the Society, February 2, 1898.

room was reported by the sister as having been very strong while he yet breathed. But she thought nothing of that, for he had often used it on a varicose ulcer of the leg. The ulcer referred to, however, had evidently not been dressed for a number of days.

I decided to make an autopsy on the following morning; not because I had any reason to suspect foul play, but, first, because I had never seen a case of carbolic-acid poisoning, and, secondly, because it occurred to me that I might require such practical knowledge, at some future time, to better serve the interests of the State — though I am not certain that such excuses are justifiable.

The autopsy was held in his bedroom at 10.30 A. M. on the following day, the body having lain on a cooler over night. Rigor mortis was now complete, and there were hypostatic spots, deeper in color and covering a larger surface of the back and limbs. The odor of carbolic acid was not detected by any one present before the body was opened. On opening the abdomen the excessive fatty condition of the abdominal walls, the omentum, etc., was marked.

The outer wall of the small intestine throughout the first six feet of its length from the stomach appeared to be hard and extremely congested, dark red in color, and presenting to the touch a boggy or sausage-like feel, retaining any indentation made upon its outer surface as though it were filled with feces. This effect seems to be due in part to the hardening effect of the carbolic acid by its coagulating the albumin, and in part to the thickening of its walls; for on opening the gut the mucous membrane was so deeply corrugated and thickened that its folds filled and reduced the lumen of the gut to such an extent that it was almost obliterated and contained only a very small amount of soapy-colored fluid of strong carbolic odor. The mucous membrane in parts was of a dirty yellowish-white color, in parts of a pinkish boiled-salmon color. The affected intestine seemed very much heavier than normal, probably due in part to the excess of water in its tissues. Bearing in mind the strong affinity which carbolic acid has for water, it might have been of interest to weigh the six feet of empty intestine so seriously affected, that we might compare its weight with that of an equal length of healthy intestine to get an approximate idea of how much water may be taken up by the acid under such conditions. To this end chemistry and the microscope would be more perfect aids.

The external appearances of the stomach were the same as those of the small intestine. It contained two ounces of opaque, light coffee-and-milk-colored fluid (with slight flocculent sediment of a yellowish cast) and smelling strongly of carbolic acid. The gastric walls were thickened and hardened, and the stomach as a whole was very markedly contracted. The mucous membrane was of a dirty yellowish-white color, roughened, and so deeply corrugated that it reminded one strongly, when it was turned inside out, of the convolutions of a brain; as one physician present aptly suggested, "his brains were in his stomach, and no wonder he died."

The mucous membrane of the esophagus was thickened, hardened and whitened but not markedly corrugated, and it looked like the surface of a wet white kid glove.

The spleen was more than twice its normal size, its capsule thickened, its surface of a light whitish-blue color. On attempting to remove the spleen it tore readily. Its tissue presented a deep purplish color, and was so much softened that it dropped to pieces by its own weight.

The kidneys were deeply imbedded in fatty tissue; they were slightly enlarged and moderately congested. The capsules were easily removed. The anterior surface of the fatty tissue surrounding the right kidney had over an area of two by three inches, a light brown, dried, cauterized, granular appearance where it lay in contact with the small intestine, showing that the effect of the carbolic acid had passed through the intestinal wall.

The liver was hypertrophied, but quite normal in color.

The gall-bladder was fully distended with a pale, thin, green, biliary fluid.

The bile-duct contained two gall-stones, each the size of a hazel-nut.

The urinary bladder contained one and one-half ounces of pale yellowish urine, of acid reaction.

Just anterior to the prostate gland was a firm and very narrow stricture, which I learned later had been causing him much trouble. I was very much impressed by the fact that the pelvic and abdominal cavity throughout was noticeably free from moisture, as were also the pleural cavities and the pericardium; all these parts were exceptionally dry.

There were extensive and very general, firm, fibrinous adhesions of the pleura of the right lung to the chest wall and to the diaphragm, which, in turn, was firmly adherent to the liver. On the surface of both lungs there was considerable bluish-black pigmentation of carbon deposit. The same pigmentation was sprinkled throughout the lung tissue. Some post-mortem hypostatic congestion of the posterior part of the lower lobes was seen; otherwise the lungs were not congested, but considerable mucus was found in the larger bronchial tubes, especially at the bifurcation of the trachea, where the mucus was thick, ropy and of a reddish cast. The mucous membrane of the trachea was reddened throughout its lower half, where it lay in contact with the esophagus.

The pericardium was normal. The heart was hypertrophied, and there was excessive fatty degeneration of the same. The left ventricle was firmly contracted. The right ventricle was flaccid; its muscular tissue had a pale lavender color, and was very friable as were also the columnæ carneæ. The valves were all normal. The veins were well filled with fluid blood; the arterial system was quite empty.

The blood was everywhere thin, black and fluid; not a trace of a clot to be found anywhere.

The head was not opened.

With the exception of the evidence of an old pleurisy, we find here some of the pathological conditions which are attributed to the habitual and excessive

use of alcoholic stimulants blended with those quoted as directly referable to carbolic-acid poisoning; the latter being the extreme general pallor of the skin, the condition of the alimentary canal as described, the contracted pupil, the firmly contracted left and the flaccid right ventricle, the very dark and perfectly fluid condition of the blood everywhere, the reddened mucous membrane of the trachea and excess of thick mucus there found; and, may I not add, though I have nowhere seen it mentioned by any author, the peculiar freedom from moisture of the pelvic, abdominal and pleural cavities and the pericardial sac. This I suggest as a post-mortem effect of a large dose of pure carbolic acid which it might be well for us to consider in our future cases, and which some one of you may have already noted, though I can find no reference to it in any work on toxicology. Some authors, Witthaus and Becker, for example, are most lamentably brief and incomplete in their description of the post-mortem appearances, while some others are inclined to be too dogmatic and not broad enough in their description of post-mortem effects of this poison.

The contents of the stomach answer all tests for carbolic acid; though from the one and one-half ounces of urine which was collected from the bladder I could not only discover no smell of carbolic acid but on standing exposed to the air for three days it never changed to the olive-green or other shades so frequently referred to in text-books, and upon which so much stress is laid as characteristic of carbolic-acid poisoning. On agitating it with ether I could not, on evaporating, get the slightest smell or trace of carbolic acid.

I believe that in most doubtful cases of carbolic-acid poisoning, accompanied with retention of urine, and in cases when death is not so rapidly fatal as in this, we are more likely to find the carbolic acid in the urine.

THE BUTTERS HOMICIDE AFFAIR.[1]

REPORTED BY GEORGE E. TITCOMB, M.D., CONCORD, MASS.,
Medical Examiner.

On the 4th day of September, 1897, J. M. Harris, aged forty-eight years, came to Concord from Waltham, arriving at a few minutes after 12 o'clock, noon. He proceeded to the house of G. S. Butters, in which were Mrs. Butters and her son Carl, shot and killed Mrs. Butters, fired two bullets into Carl and one into his own head. At between 12.30 and 12.40 P. M. of the same day, I was summoned, by telephone, to go in haste to the Butters house, about one-eighth of a mile distant from my office. On my way to the Butters house I met Carl with blood upon his face, neck and clothing. He exclaimed that his mother had been murdered.

At my arrival upon the scene, I found Mrs. Butters lying upon the kitchen floor, dead. Harris was in the adjoining shed, sitting upon the floor, with blood oozing from a bullet wound in the right side of the head and from his nostrils. On a line with the floor of the orbit, this wound was about one inch above and one inch beyond the external border. The edges of the wound were blackened and charred. Harris seemed somewhat dazed and under the influence of alcoholic stimulants; but when asked if he shot Mrs. Butters, replied, "I am twenty-one, as well as you." Harris and Carl were sent to the Massachusetts General Hospital for treatment.

I found upon inquiry that Harris entered the Butters house by the shed door; had some conversation about money with Mrs. Butters and Carl in the kitchen. Carl sat down and began to write, with Mrs. Butters and Harris standing. Carl heard a report, saw his mother fall, arose, received a shot, staggered, when he received a second shot and fell. As he again arose, a third shot was fired at him, but the bullet entered the body of Mrs. Butters. Harris then sent a ball into his own head.

At 7.30 o'clock in the afternoon of the day of the murder, I made an autopsy. The body was well nourished. Rigor mortis was present. Blood stains were upon the forehead, and blood was in the nostrils and in the wound in the left side of the head and over the left side of the head and face. Blood stains appeared also upon the fingers of the right hand. There was a wound in the right side of the body between the seventh and eighth ribs, two and a half inches below the right nipple and one inch to the right of it.

Internal examination: About a pint of blood was found in the upper part of the abdominal cavity. A bullet entered the right side of the body between the seventh and eighth ribs, as noted in the description of the external wound,

[1] Read before the Society, February 2, 1898.

passed through the anterior part of the right lobe of the liver, lacerating the under side of the left lobe, thence to the stomach, perforating the anterior wall twice near the pyloric end; thence to the ninth rib on the left side, fracturing the same one and a half inches from its attachment to the costal cartilage. This ball was found in the tissues between the fractured rib and the outer surface of the body.

External to the wall of the uterus there were two small fibroid tumors. The kidneys were contracted. Other than this the organs of the abdominal and thoracic cavities were practically normal.

There was a bullet wound midway between the external canthus of the left eye and the lower end of the lower lobe of the left ear. A director was passed through this wound four and a quarter inches inwards, downwards and backwards. When the cranium was opened, the dura mater was seen to be normal. Clotted blood lay under the pia mater, between the convolutions and in the cavities of the brain. There was a comminuted fracture of the basilar process of the occipital bone and the bullet had lodged in the soft tissues to the right and below. The bullet did not enter the cranial cavity. It came in contact with the basilar process on the under side.

From the evidence obtained I came to the conclusion that the bullet which entered the left side of the head of Mrs. Butters was the one which she first received and the one which caused her death, that being the side of the body presented to the assailant when the first shot was fired. As Mrs. Butters fell she turned over upon her back presenting the right side of her body to the assailant, and the ball which entered this side was probably intended for Carl, as he was between his mother and the murderer when fired at the third time.

I find from the hospital records that when Harris entered, there was no vision in the right eye; no paralysis and no head symptoms. Observations with the x-rays gave negative results. On September 10, 1897, the right eye was removed and a shaving of a bullet was found in the substance of the lower lid.

Carl stated that the shooting occurred when his assailant was about four feet away. There were powder grains in the side of his face. Just outside the left ala nasi there was a wound with ragged blackened edges. Another wound of entrance was found just outside the left sterno-mastoid, about one inch and a half from the clavicle. The x-rays showed one bullet near the transverse process of the vertebræ on the right side, close under the angle of the jaw; the second bullet was located just above the clavicle and outside the sterno-mastoid on the right side. There was no special disturbance from these bullets.

Harris at his preliminary hearing pleaded not guilty. He was indicted in October, 1897, by the grand jury. He was arraigned in December, 1897, and pleaded not guilty. January 10, 1898, he pleaded "guilty of murder in the second degree" and was sentenced by the court to imprisonment for life. At this session of the court, District Attorney Weir, after giving

a brief account of the crime, stated the position of the prosecution, as follows:

At the last October term, the grand jury for this county returned into court an indictment against Harris charging him with the murder of Mrs. Butters. To this indictment he has now pleaded that he is guilty of murder in the second degree. The attorneys for the Commonwealth, after careful consideration, have decided to accept this plea. They do this because they believe that the evidence does not warrant a finding beyond a reasonable doubt that the act of Harris was done with that deliberate premeditation which, if the case was tried, would justify a jury in returning a verdict of guilty of murder in the first degree. They believe that the evidence indicates that Harris was acting upon an impulse of the moment rather than upon any prearranged plan. There can be no doubt that Harris's attempt to take his own life was genuine. He was so seriously wounded that it was thought for a time that he might not recover. The bullet entered his head and has not yet been extracted and he has thereby lost the use of one eye. The fact that besides attempting suicide, he tried to kill two persons with whom he had been on more or less friendly terms has some tendency to show a want of deliberation. It is now known that it had been the custom of Harris to carry a revolver, and the fact that he had one with him on the day of the murder does not, therefore, of itself prove premeditation.

Since his confinement in jail he has been carefully examined by two experts on mental diseases, one, Dr. Jelly, of Boston, at the request of the Commonwealth's attorneys, and the other, Dr. Cowles, of the McLean Hospital, at the request of the counsel of the defendant. The physicians agree that he was sane at the time of the murder and is now sane, but they both admit that, considering all the circumstances, he might have been acting more or less automatically at the time, because of his long continued use of alcoholic stimulants and because of his excessive use of them on that and the preceding day, and they cannot say that he was not so acting. The Commonwealth has no evidence which can materially control the inference to be drawn from the facts of the case as here presented that Harris was acting upon impulse rather than from any preconceived purpose. There seems, therefore, to the prosecuting attorneys to be a want of proof of that deliberate premeditation which is and should be required in all cases before a verdict of guilty of murder in the first degree can be justified. For this reason the plea of guilty of murder in the second degree which Harris now makes and which means that his punishment is to be imprisonment for life is accepted. This decision, if it is right, means that a trial is now unnecessary and that the county is legitimately relieved of the great expense of a murder trial. It is also proper to state at this time, that Mr. Butters, the husband of Mrs. Butters, and their son, Carl, approve of this disposition of the case.

Mr. Adams spoke briefly for the defence, stating that the defendant's plea was made on the advice of his counsel, and that the end would probably be the same if a trial was held. Judge Fessenden then imposed sentence.

CHOLIN, THE ACTIVE PRINCIPLE IN FLORENCE'S TEST FOR SEMEN.[1]

BY WM. F. WHITNEY, M.D., BOSTON.

AT the meeting of the Society a year ago, I presented the results of my investigations[2] of the iodine test for seminal stains first published by Florence[3] and which he regarded as the reaction of an alkaloidal substance peculiar to the semen, which he called "virispermin." Since then the subject has been studied by Richter,[4] who has shown that it is not a specific substance, but one of the products of the decomposition of albuminoid material, namely, licithin, or perhaps more properly one of its products, cholin, which gives the reaction.

He has been able to obtain the test crystals from portions of all of the organs of the body, white of egg, etc., which have been allowed to decompose, as well as from the isolated chemical substances themselves. I have also obtained them from the adrenal gland (which contains licithin in a relatively large per cent.) by allowing it to stand at the room temperature for twenty-four hours and then testing the fluid expressed from it.

The semen, however, still seems to be the only secretion in which this substance is always formed quickly and in large amounts after drying, and therefore these observations do not impair the value of the test as a preliminary one; for by it those stains can be readily picked out on which time should be spent in searching for the only positive proof of semen, namely, the spermatozoa.

[1] Read before the Massachusetts Medico-Legal Society, February 2, 1898.
[2] The Identification of Seminal Stains, Boston Medical and Surgical Journal, 1897, No. 14.
[3] Du sperme et de tâches de sperme, Arch. d'Anthropologie Criminelle, tomes x et xi.
[4] Du mikrochemische Nachweis von Sperma. Weiner klinischer Wochenschrift, 1897, No. 24. Die Spermaprobe von Florence, Zeitsch. f. Medizinalbeamte, 1897, No. 21.

APPENDIX.

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